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ABSTRACT

This middle/junior high school unit on wetland ecology consists of 12 activities and activity packets containing data sheets, activity sheets, flash cards, game cards, and other materials needed to complete the activities. The first activity is the text for a slide-tape show which provides an overview of the entire unit. Each of the remaining activities is then presented under five headings: (1) objective; (2) background; (3) activity; (4) summary; and (5) going further. The objective tells what students can gain from doing the activity. The background gives information about the subject matter of the activity and, when applicable, explains why the activity is important. The summary consists of several questions to be answered after the activity is completed. Going further is a section with suggestions for additional activities. Among the topics considered in the activities (which may be completed in any order) are endangered wet lands, how to visit a wetland, identifying wetland plants and animals, ecological niches in wetlands, food chains, wetland soils, and motion in wetlands. In addition, instruction for creating art objects related to feelings about wetlands are provided. (JN)

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Hanging on to the Wetlands

Book II

SE044520

Hanging on to the Wetlands

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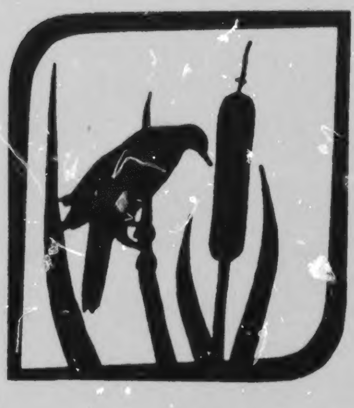


An Introduction to the Student

Hanging on to Our Wetlands is a unit on ecology. You will learn about a special kind of environment known as a wetland. This unit consists of 12 activities. Each activity is introduced in this book. Activity materials are contained in the 12 pockets of the canvas frame.

Activity #1 is a slide/tape show. This program will give you an overview of the entire unit. In the first part you will find out what a wetland is. Then you will see examples of different kinds of wetlands. Pictures of plants and animals of the wetlands will introduce you to the special characteristics of wetlands. The next part of the program explains the importance of wetlands. Then a series of slides describes what happens to wetlands after humans change them. Finally, the show considers the actions people take to protect and preserve the wetlands.

After the slide tape show you will select activities to do. The eleven remaining activities are numbered in order of their introduction in the slide/tape show. However, you do not have to do the activities in any particular order. You might choose to do Activity #8 first and Activity #3 second. But before you decide which activity to do first, look over all of the activities. They are described in this book.

Each of the eleven activities is presented under five headings: OBJECTIVE; BACKGROUND; ACTIVITY; SUMMARY; and GOING FURTHER. The OBJECTIVE tells you what you can gain from doing the activity. The BACKGROUND gives you some important information about the subject of the activity. This section may also explain why the activity is important. The ACTIVITY tells you what you will be doing and how to go about it. The SUMMARY section consists of several questions. You should be able to answer these questions after you do the activity. GOING FURTHER is a section with ideas about more things to do. This section is for students who find the activity especially exciting.

The twelve pockets in the canvas frame contain the guidesheets, references, and a few of the materials you will need to do the activity. You will find that some of the materials for activities will have to be gathered from school or home. Books for additional reading will have to be found in a library.

Near the close of your unit study you may want to watch the slide/tape show again. After doing some of the wetland activities, you may see some new things in the slide/tape program.

1

An Introduction to Wetlands

1. A swamp is an interesting place to visit.
2. You have probably been to one yourself . . . or seen pictures of one . . . or read about a swamp.
3. But did you ever think about the ways a swamp can be used? Recreation is one use. It's fun to paddle a canoe through a swamp . . .
4. . . . or to go fishing
5. . . . or to learn about nature.
6. Swamps can be used in other ways, too. The trees in a swamp can be cut down for timber.
7. Or swamps can be drained to make farm land.
8. Or roads can be built on them.
9. Or they can become locations for new homes.
10. What's the best way to use a swamp? Should we leave it just the way nature made it?
11. Or should we change it so that it can be used by humans in some other way?
12. People are asking these questions more often today.
13. This slide set will help you think about swamps and other wetland areas. In the set, we'll explain what a wetland is. We'll find out what kinds of wetlands there are. We'll learn about the plants and animals that live in wetlands. We'll see how wetlands can be used by humans. We'll find out what's happening to wetlands right now. And we'll see how you can get better at making decisions about wetlands.
14. What are wetlands? You can probably guess from the name. They are areas that are under water most of the time.
15. They may be dry for part of the year, like this swamp.
16. But they are covered with water for most of the year.
17. Is there a wetland in your area? There probably is a swamp, marsh, or bog near your home. If so, you may want to visit the wetland. You will probably see plants and animals that you can see nowhere else. Activity 3 will show you how to plan a field trip to a wetland.

18. What name do you use for your wetland? Marsh, swamp, bog, pothole, slough, fen? All of these are names for different kinds of wetlands. Let's see how wetlands differ.

19. Swamps are found mostly in the Southeast and the North. Sometimes they form at the edge of the ocean. Woody plants are common in swamps. Some swamps like the one shown here are known as mangrove swamps because mangrove trees are the most important plant living there.

20. Northern swamps are found in low-lying areas that fill with water in the wet season.

21. During the summer these places may dry up completely. But the area is still a swamp.

22. Some marshes occur along the coastline also. You can find them at the mouth of a river. These marshes are called saltwater marshes.

23. Sometimes salt marshes are found far from the ocean. This one is located in New Mexico. The saltwater in this marsh does not come from the ocean. It is produced when minerals in the soil dissolve during rainstorms. During the dry season the water evaporates leaving caked mineral salts behind.

24. Most inland marshes, though, are freshwater marshes. There are almost no minerals dissolved in these waters, as there are in saltwater marshes.

25. Freshwater marshes form in hollow spots in the ground. Water comes from rainfall. from springs. or from streams. When ground conditions are just right, the water stays there for most of the year. Plants and animals adapted to watery conditions live on the marsh.

26. Bogs are like marshes in some ways. They, too, are big puddles of water. The water in bogs usually has no place to go, however. It doesn't drain off into the ground or into a stream. The longer it remains there, the more it changes.

27. The soil and water in bogs is quite unusual. Only very special kinds of plants can live there. A bog fills with moss and plants and, after a few hundred years, turns into a meadow and then a forest. Bogs usually occur in cool climates. They are very common in Minnesota, Wisconsin, Michigan, and the Dakotas.

28. Why does one area become a swamp, another area a marsh, and a third area a bog? Many factors are involved: climate, soil type, depth of water, location, and geological history, for example. You may want to study this question in more detail sometime during this unit.

29. The wetlands we've seen seem very different from one another. Are they alike in any ways? You may be able to guess one answer to that question. For one thing, all wetlands contain water.

30. There may be some ways in which the water differs from one wetland to another. It may be salty or fresh, or it can be warm or cold. But the water is always--or nearly always--there.

31. It is usually shallow water, too. In most wetlands, the water would not come much above your knees.

32. The soil in wetlands may be similar, too. In many cases, a wetland soil acts like a sponge, soaking up and holding water. The sphagnum moss you see here grows in bogs. Activity 7 will help you see how good moss is at soaking up water.

33. Perhaps you'd like some practice in telling wetlands apart. If so, try Activity 2.

34. You can tell wetlands apart simply by looking at them in many cases. But wetlands differ in another way: by the plants and animals that live there. In this unit we'll talk a lot about that. We'll see how bog plants are different from saltwater grasses.

35. In fact, learning about wetland organisms will be one of the most important goals of this unit. Activity 4 should come early in the unit. It will help you find out about some common wetland animals and plants.

36. You probably know some wetland organisms already. How many of the following can you recognize? Perhaps you will learn the ones you can't name as you go through the activities in this unit.

37. - 47. (slides of organisms--no script) ____ ____ ____ __ _ ____ ____ ____
____ ____ ____ __ _ ____

48. Learning organisms one at a time is not enough, however. We also need to understand why certain plants and animals live together in a wetland. Activity 5 will help you to think about wetlands as homes for the organisms that live there.

49. The way that plants and animals relate to one another is also important. Nothing lives by itself in a wetland. Every organism eats and is eaten by other organisms. Activity 6 explains the idea of food webs.

50. Wetlands are useful to humans in many ways. Both plants and animals grow well in marshes, swamps, and bogs. For example, these shrimp were taken from the ocean. But they spent part of their life in a salt marsh.

51. You've probably eaten cranberries. But did you know they came from a bog? The acid soil, cool temperatures, and abundance of water are just what the cranberry needs to grow well.

52. Wetlands are important to people who like to hunt and fish. The potholes in the Northern Plains states are breeding grounds for most of our duck population.

53. The benefits that come from wetlands are not always easy to see. For example, marshes and swamps help protect against floods. In places where wetlands have been destroyed, flood problems get worse. Activity 7 will explain more about this subject.

54. Wetlands also help to control pollution. Wastes that are dumped into a swamp or marsh often stay there. Many wetland plants can use some wastes to grow. Others like marsh grass and cattails, can store chemicals in their stems. Of course, there is a limit to the wastes we can dump in a wetland. Too much waste can kill a swamp or marsh.

55. For many people, the value of wetlands is not measured in dollars. Swamps, marshes, and bogs are important just because they are so beautiful. People are inspired to write, paint, and sing about the things they see in wetlands. Activities 8 and 9 will give you a chance to do the same.

56. Not everyone is happy to leave wetlands just as they are. Many people think that there are better ways to make use of a swamp or marsh. For many years, we have been changing our wetlands. For example, the soil in a wetland is rich and nutritious. It makes good farm land. So we sometimes drain the water and use the land for growing crops. . .

57. Or we dredge and fill them for housing developments. Access to open water and beautiful views make them desirable places to live.

58. Americans are producing huge amounts of solid wastes today. It is becoming difficult to find places to dump them. Wetlands take up a lot of space; people don't usually live there. So, some people think wetlands should be used as dumps.

59. Dredging a wetland makes it better for boat travel. This makes people who own boats happy. But dredging also disrupts the community of organisms that live in a wetland. Who should we be most concerned about: boat owners or wetland organisms?

60. Industries sometimes pour their wastes directly into a wetland. We saw that wetlands can handle small amounts of pollution. But large amounts can destroy a swamp or marsh.

61. Industrial accidents can also destroy a wetland. This scientist is testing the effects of an oil spill on an Artic wetland.

62. Wetland plants and animals--like this duck--are innocent victims of industrial accidents.

63. Even the actions of individuals can add up to serious damage of a wetland.

64. If possible you should visit an endangered wetland in your own area. Activity 10 will tell you how to plan that visit.

65. So we come back to the original question: What should we do about our wetlands? Are there times when they should be left just as they are? Are there situations in which they should be filled, drained, dredged, or destroyed? Perhaps the real question is how we can best get along with the rest of the natural world. Can we find ways to make our own activities fit in with those of other life on this planet?

66. These questions are almost never easy. Different people have very different ideas. Activity 11 will introduce you to a problem like this. The question is whether a marsh should be sprayed for mosquitoes. . .or whether we can find other ways to live with the pests.

67. The future of our wetlands is now a topic of discussion at every level. The Federal government has passed legislation on the subject. The Clean Water Act of 1977, for example, places certain conditions on the uses of wetlands.

68. At the local level, citizen groups are becoming more involved. Individuals are beginning to think about the fate of our swamps, marshes, and bogs. Debates are going on about the best way to use these wetlands.

69. What do people in your town think? Activity 12 will show you how to conduct a survey to answer that question.

70. You may not have to make decisions about wetlands yet. But that time will come. You will have to make up your mind about the fate of your wetlands. Is testing for oil, as shown here, a good way to use wetlands? Should we do whatever we want to wetlands. . .change them any way people want? . . .

71. Or should we leave them in a natural state?

72. These are not simple questions. They require careful thought and planning.

73. But one of our greatest resources is at stake. The decisions you make in this generation will affect the lives of your children and grandchildren. That is an exciting challenge for any generation.

2

Puzzling Out the Wetlands

OBJECTIVE In this activity you will solve the puzzle of the mixed-up wetlands. You will put together jigsaw pictures of four wetlands. In another puzzle you will look for the names of plants and animals that live in each of the wetlands.

BACKGROUND Wetlands have distinctive characteristics. The type of wetland can be told by the kinds of plants that grow there. If the vegetation is tolerant of salt water, then the wetland is a saltwater marsh. Sphagnum moss is a sure sign of a bog. And it's a rare freshwater marsh without cattails.

We call special plants of a wetland a plant community. The plant community attracts a special community of animals. When you see a wetland you probably won't notice the water and soil. But you will notice the characteristic plants and animals. A trained eye can tell a lot about a wetland with a mere glance at the landscape.

THE ACTIVITY

In Activity Packet #2 you will find a box with the pieces of four jigsaw puzzles. They are all mixed together. Put together correctly, you will have four different pictures. Each is 8½ inches by 14 inches. They are pictures of a salt marsh, a bog, a freshwater wetland, and a swamp.

The names of 20 plants and animals living in these four wetlands can be found in a word puzzle. Your copy can be found in the envelope titled WORD PUZZLE. After you find the name of the organism, see if you can find the organism in one of the puzzle pictures. Write a "B", "FWM", "SM" or "S" after the name to show that it is a Bog, Freshwater Marsh, Salt Marsh, or Swamp organism.

SUMMARY QUESTIONS

1. What do you observe to be the big difference between bogs, freshwater marshes, salt marshes, and swamps?

2. What determines which plants will grow in the various wetlands?

GOING FURTHER

1. Search for pictures of landscapes in magazines. How many of these pictures show a wetland? What clues can you use to identify the wetland?

2. Find some aerial photographs and/or some satellite photographs of Earth. How do wetlands show up in these pictures. What additional information about wetlands can you learn from aerial and satellite views?

3

The Field Trip

OBJECTIVE

In this activity you will investigate a wetland. There you will carry out a study of one feature of this special environment. Your study should increase your knowledge of ecology and your skill in research.

BACKGROUND

Wetlands are environments in which certain kinds of living and nonliving things are found together. The organisms depend on one another for food and shelter. The organisms also depend on water, the soil, the sunlight, and the temperature in a wetland. The wetland is a delicately balanced system. To understand the system of a wetland is to know all the parts and how the parts work together. The usual field study of a wetland involves three major steps.

1. The student looks over the whole wetland.
2. The student carries out a special study of one part of the wetland. The parts studied may be the water, the soil, the birds, or the floating plants.
3. All students put their studies together. By listening to, reading, or looking at other student's reports, all students learn about the whole wetland system.

THE ACTIVITY

In Activity Packet #3 you will find an envelope labeled FIELD TRIP TASK CARDS. Inside the envelope are 12 printed cards. Each card describes one task to carry out on a field trip to a wetland. Read over the cards. Choose one card you are most interested in using. The subjects on the cards are:

1. Scavenger Hunt in the Wetlands
2. Frogs
3. Wetland Plant Collection
4. Plant Map
5. Wet Pets
6. Animal Signs
7. Temperature Map
8. Bird Watching I
9. Bird Watching II
10. Photography
11. Record an On the Spot News Broadcast for Station WETS
12. Mud

SUMMARY

Report the findings of your study in one of the following ways:

1. Prepare a written report. Give it to your teacher. These reports may be displayed on the bulletin board, or made into a book.

2. You may decide to show the results of your field study in a display of things collected, pictures taken, or charts drawn.

3. You may choose to make an oral presentation. Certainly the recording of wetland sounds needs to be heard. The whole class together can discuss all the information collected.

GOING FURTHER

1. Carry out a second field trip task.

2. Carry out your wetland study in a second wetland.

3. Think up your own investigation to carry out in a wetland.

4

Knowing the Organisms

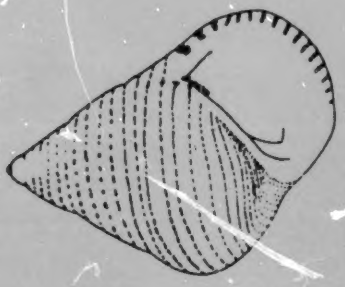
OBJECTIVE

"I know that bird!" "That's a pitcher plant!" It's fun to recognize wetland plants and animals. And it's important to know what you're looking at when you're in a wetland. This activity will help you master the names and shapes of 40 different wetland organisms.

BACKGROUND

"Getting to know you,
Getting to know all about you;
Getting to like you. . ."

Do you know these wetland organisms?



Learning the plants and animals is the first step in getting to know about wetlands. You can't say that you know what a swamp is like until you can recognize a cypress tree or an alligator. In this activity you'll learn how to recognize and name 40 of the most familiar organisms in swamps, marshes, and bogs.

THE ACTIVITY

1. There are four sets of cards in the envelope. One set is for cypress swamps, another for bogs, another for salt marshes, and a fourth for freshwater marshes. Choose one set to work with. Take out only cards 1-10 to start.

2. Find another student to work with. Practice learning the shapes and names of the organisms in your set One person can show the cards while the other names them. Then you can switch places. Keep practicing until you can name all 10 organisms.

3. Now take out cards 11-15. These show only one part of an organism from your wetland. Learn how to recognize and name the organism from just the part you see. You can use the same method as in step 2.

4. Once you've finished one set of cards, go on to another set. You should become expert on all four types of wetlands.

SUMMARY QUESTIONS

1. List ten organisms that are commonly found in your wetland.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

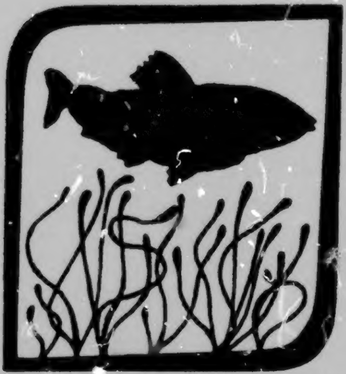
2. Name one special characteristic of each organism you listed in #1.

3. For cards 11-15, tell why just that part of the organism was chosen to show. What's special about that one part?

GOING FURTHER

1. There are many games you could invent using these flash cards. For example, the class could be divided into two teams. A student could be chosen to show the cards one at a time. The team that gets the answer right first earns one point for each card #1-10. It gets two points for each card #11-15.

2. You could make a second set of cards showing ten more organisms from each wetland area. The cards could be more attractive and more helpful if you used colors. Choose the right colors for each plant and animal.



5

Ecological niches in the Wetlands

OBJECTIVE

Why do moose live in wetlands and elk do not? Can moose and beavers feed on the same plants of a marsh and still live together? Organisms must have special characteristics to live in wetlands. In this activity you will recognize some of the special traits of organisms that suit them to particular parts of their wetland home.

BACKGROUND

Ecological niche is a special idea in biology. The niche of a species is a combination of everything it needs to survive in the environment. The niche of the fiddler crab is mud to burrow in, tides to wash in, pieces of decaying plants, moderate temperatures, and crowds of fellow species.

Only one species can live in any particular niche. Often times several species appear to have an identical life style. They seem to occupy the same niche. Whirligig beetles and water striders swim or skate on the surface of the water. Both feed on animals. But the beetles will eat animals that are below the surface of the water. The water striders eat only animals above the surface of the water.

Sometimes, two or more species compete for parts of the same niche. Early in the breeding season redwing blackbirds take over all the trees of a wetland. Later the larger, tricolor blackbirds move in. They drive the redwings out of nesting sites in the central area of the wetland. The niche of the redwing in the presence of the tri-wings is then limited to the edges of the wetland.

Species have special adaptations so they can survive in their niches. Some adaptations are visible. The long wading legs of the egret is one example. The salt excreting glands of the saltmarsh grass are another. Many adaptations are difficult to see. The ability of cattails to tolerate freezing weather is an example. The cranberry plant's strong preference for acid water is another.

THE ACTIVITY
Niche Mysteries

Activity Packet #5 contains an envelope marked NICHE MYSTERIES. Each of the eight cards in the envelope is a puzzle. On each card you will find two similar species apparently occupying the same ecological niche. On the back of the card are the names of the species. Under each name is a list of the niche requirements of the species.

Your task is to identify the one species that is out of place. You should also describe why that species is not in its proper niche.

Create An Organism

In a second task, a niche is described to you. You are told many of the physical, chemical, and biological elements of the niche. Your task is to invent an animal that would survive in the niche. Draw a picture of an animal that is suited to this environment.

Create A Niche

In a third task, a prehistoric animal is described to you. You are told many of its characteristics; its structure, functions, behaviors, and needs. Your task is to restore the special environment in which this wetland organism probably lived millions of years ago. Draw a picture, in full color, of the landscape which suited the needs of this prehistoric animal.

SUMMARY
Niche Mysteries

1. For each card, indicate (1) which species is not in its proper niche, and (b) why it is out of place.

1. a

b

2. a

b

3. a

b

4. a

b

5. a

b

6. a

b

7. a

b

8. a

b

Create An Organism	2. Attach your picture of the organism you invented to fit into the ecological niche.
Create A Niche	3. Attach your picture of the environment in which you think the prehistoric organism lived.
GOING FURTHER	Visit a wetland and observe two organisms which appear to occupy the same niche. Then describe how their actual niches differ.

6

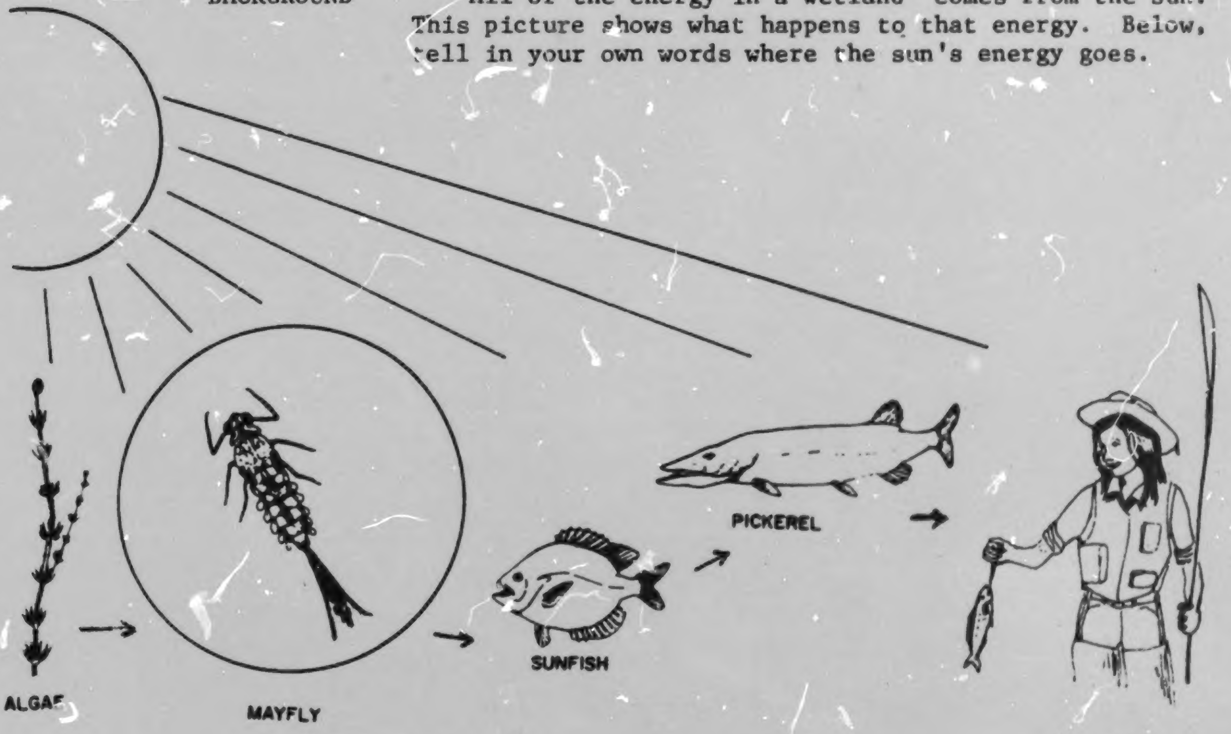
The High Cost of Eating

OBJECTIVE

Eating is an organism's way of getting energy. In this activity you'll see how energy is passed through a wetland's food chain. You'll discover that more energy is lost than passes through the food chain.

BACKGROUND

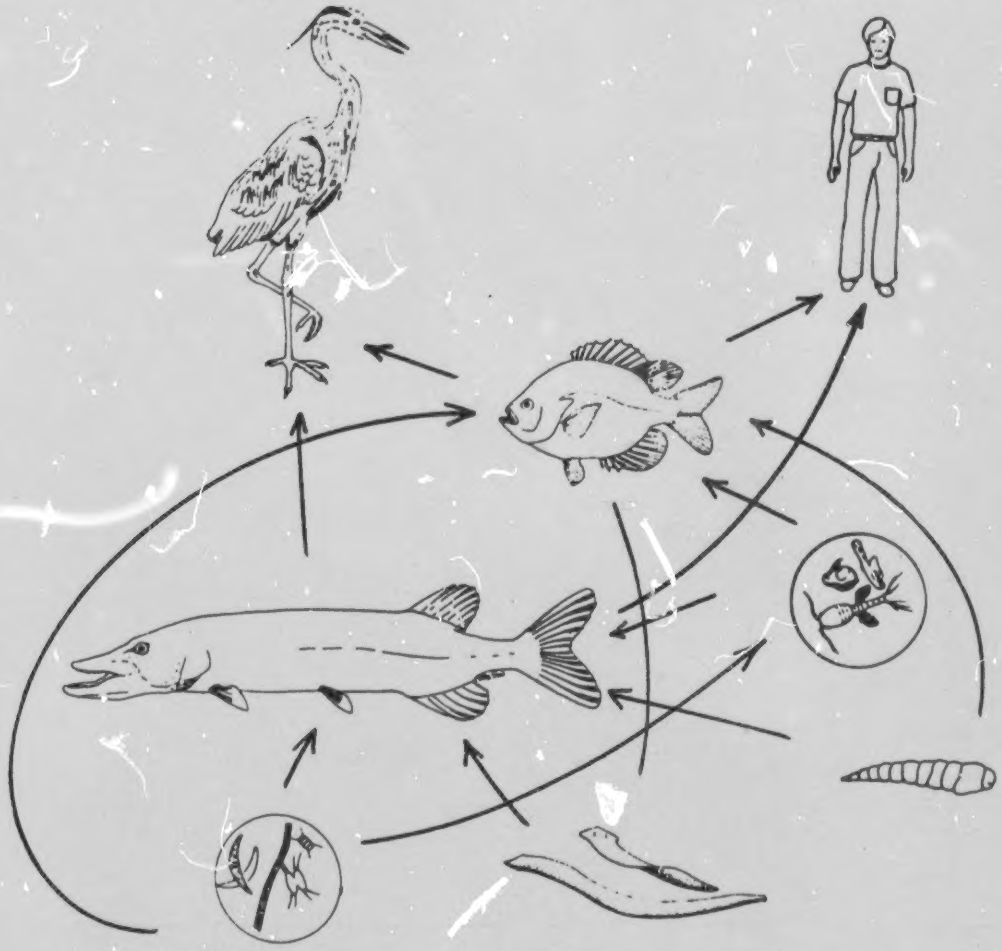
All of the energy in a wetland comes from the sun. This picture shows what happens to that energy. Below, tell in your own words where the sun's energy goes.



The series shown here is called a food chain. It starts with the plants. Plants get energy from the sun. They use this energy to make food by photosynthesis. Algae are water plants. They are eaten by mayflies and other insects. They take some of the sun's energy stored in the algae. Bigger fish eat smaller fish. And humans eat the biggest fish. Food and energy are passed along the chain.

But a lot of energy is wasted along the way. Only about 3% of the sun's energy is ever used by a plant. The rest gets lost before photosynthesis. Energy is measured in Calories. Of 10,000,000 Calories of sunlight, about 300,000 are captured by plants. These calories are stored in plants in such organic compounds as sugar, starch, and cellulose. A mayfly gets only about 10% of the energy captured by a plant. That's only .3% of the energy that came from the sun in the first place. And so on up the chain.

Our story is not quite complete. Dinnertime in the wetlands is more complex than this. A sunfish eats other organisms besides mayflies. It also eats other insect larvae, zooplankton, and worms. And, in turn, the fish is eaten by other animals: herons, larger fish, and humans. A complete description of who eats whom is called a food web. Here's what a food web for this wetland might look like:



The board game in this activity will help you learn more about the way energy is passed through a food web.

THE ACTIVITY

1. The materials you will need for this activity are:
   - a. game board
   - b. Energy Loss Catalog
   - c. a die
   - d. calorie bills
   - e. a marker
   - f. scratch paper
2. The object of the game is to be eaten by the Marsh Hawk or the human, and to be the player with the greatest number of calories remaining.
3. Here are the rules for the game:
   - a. Two to six can play at once.
   - b. Each player begins at the sun with 10,000,000 calories.
   - c. In turn the die is rolled. Each player follows a sunbeam to a plant at yellow circles 1 through 6, according to the number rolled.
   - d. Between the sun and plant players lose 97% of their energy. Players are left with 300,000 calories [3% of the energy started with]. The players must surrender the appropriate amount of calorie bills to the calorie bank.
   - e. With each roll of the die, the player advances through the food web.
   - f. Players landing on red spaces must pay the respiration tax indicated on the square. For example, if a player with 150,000 calories lands on a red space marked 15,000, the player must give up 15,000 calorie bills to the calorie bank. The player would then have 135,000 remaining.
   - g. When a player lands on a numbered blue square, the player must check the Energy Loss Catalog. The player must surrender the calories indicated to the calorie bank.
   - h. When a player lands on a white space, no calories are lost.
   - i. As a player moves from one organism to another, the player becomes food for the new organism. Whenever this happens, 90% of the player's remaining calories must be surrendered to the calorie bank [player keeps 10% of his or her remaining calories]. You may want to keep a piece of scratch paper on hand for figuring percentages.
   - j. Players enter a new organism on the numbered, yellow circles. A player must stop on the circle, give up the 90%, and wait the next turn before advancing through the organism.
   - k. A player with no calories left has burned out and is no longer in the game.
   - l. The player reaching the Marsh Hawk or human with the most calories remaining is the winner. If every player burns out there is no winner.

SUMMARY QUESTIONS

1. In your own words, tell what a food web is.

2. What happens to most of the energy that reaches a wetland from the sun?

3. "A wetland is not a productive area because so much energy is wasted in the food web." Tell why you agree or disagree with this statement.

4. How can you explain the fact that organisms at the end of the food chain get the least amount of energy. Doesn't that mean that they are all going to starve to death?

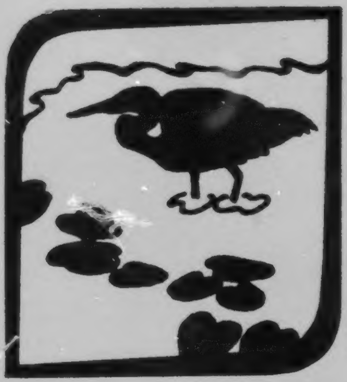
GOING FURTHER

1. Think of some variations or improvements on this game. How could the decomposers (bacteria and fungi) be added to the game? How could you make the game more "natural" by adding more of the organisms that live in a wetland?

2. The flow of energy through this food web would make a good poster. Make a bulletin board display of the idea of energy moving through a food web.

3. Do other areas do a better job of using the sun's energy? How about farmlands, tropical forests, savannahs, and the oceans? An ecology book will tell you whether the 10% "productivity factor" is the same in other areas. Choose one of these areas and make a report on the food webs found there. Be sure to point out the energy efficiency of the web.

4. Ecologists often talk about an "energy pyramid" in a wetland area. Find out what this term means. Decide how this idea helps answer question #4 above.



7

Soaking up Water

OBJECTIVE

All wetlands have one thing in common. Their soil is wet at least part of the year. In this lesson you will learn about the soil in wetlands. You will find out what kind of soil is found there. You will see why wetland soil helps control floods.

BACKGROUND

Swamps, marshes, and bogs differ from each other. Sometimes it's hard to see why they are said to be alike. But there is one thing they all have: wet ground.

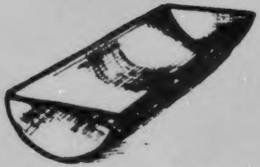
Some wetlands are under water all year. Others dry up for part of the year. But we still say they are both "wet-lands." Why?

Part of the answer is the soil. The soil in wetlands must soak up water well. What kind of soil would that be? Is it mostly sand? Clay? Moss? Sod like that you have in your yard? Maybe you can make a guess about the answer. Write down your guess on this line: ________________________________

In this lesson you will test your guess. A simple test will show you what kind of soil soaks up water best. Then you are asked to make another guess. You will try to find out how a wetland's soil helps to control floods.

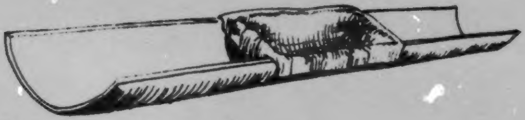
THE ACTIVITY

1. Start by finding a curved piece of metal. This sketch shows you what you want. It could be a piece of eaves troughing. An industrial arts teacher might help.



2. Next find a piece of window screen to fit the metal trough. The screen needs to have ends on it. This sketch shows you what to make.

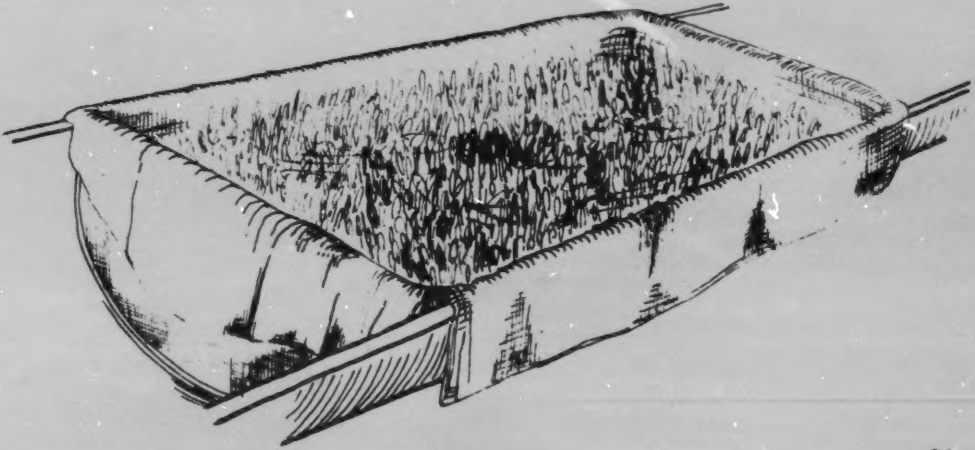
3. Then find a piece of cheesecloth to fit into the screen. Put all three parts together. It should look like this. This is your Soil Tester.



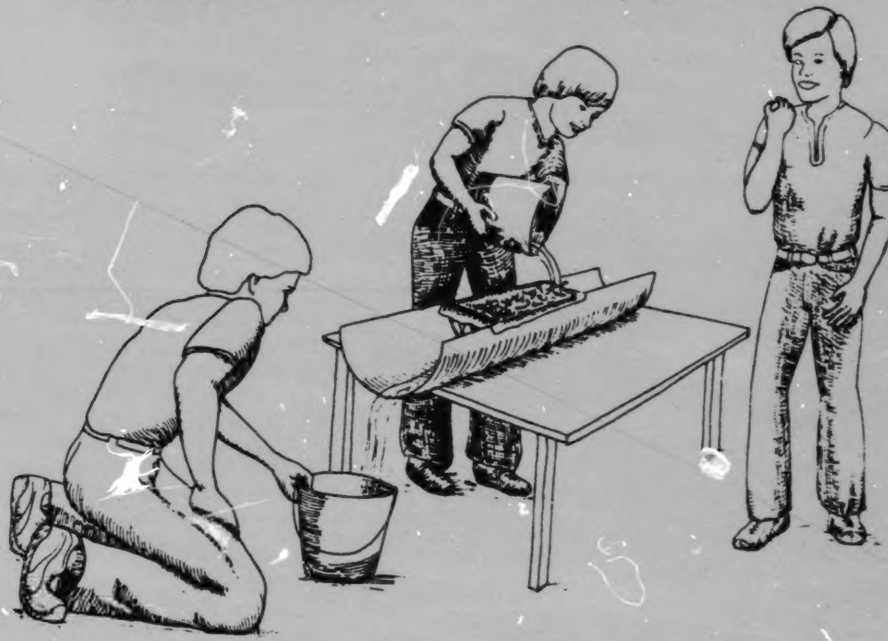
4. Collect samples of four different soils. You should have:

  a. A piece of sod from your yard
  b. Some sand
  c. Some clay
  d. Some sphagnum moss (in the Envelope)

5. Start with the sod. Put it in the Soil Tester. Pack it into the cheesecloth tightly. It should come to one inch from the top of the trough. It will look like this:



6. Fill a quart jar with water. Pour the water into the top of the Soil Tester. It will run down the trough. Some of the water will be soaked up by the sod. Collect the water that runs out the bottom. Measure the amount of water you get after one minute; after two minutes; after three minutes. Record your answers on the Data Sheet in activity packet #7.



7. Wash the cheesecloth thoroughly. Be sure that there is no dirt left in it when you begin the next test (part 8).

8. Repeat the experiment with sand. Pack the sand in the Soil Tester in the same way you did the sod. It should look exactly like the test with sod. Why? Again, record the amount of water that comes out after one minute; after two minutes; after three minutes. Wash the cheesecloth thoroughly before beginning the next test.

9. Repeat the experiment with clay. Then repeat it again, using the moss. Wash the cheesecloth between the two tests.

SUMMARY QUESTIONS

1. Which kind of soil soaked up the most water after one minute? After three minutes?

2. Which kind of soil is likely to be in wetlands? Why?

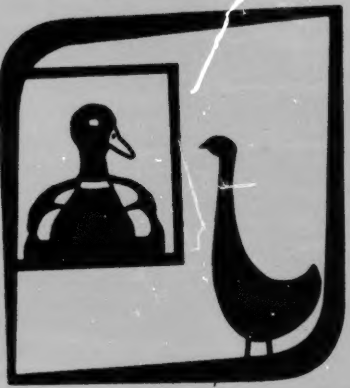
3. Wetlands help control floods. You should be able to guess the reason now. In fact, there are two different reasons. Write down your guesses about flood control here:

4. Why is it so important to begin each new test with a very clean cheesecloth?

The puzzle in GOING FURTHER will help you test your guess. Be sure to check with your teacher for the right answer when you are done.

GOING FURTHER

The envelope contains a puzzle about flood control. It will help you see how wetlands protect against bad floods. Try the puzzle and see if your guess in question #3 was correct.

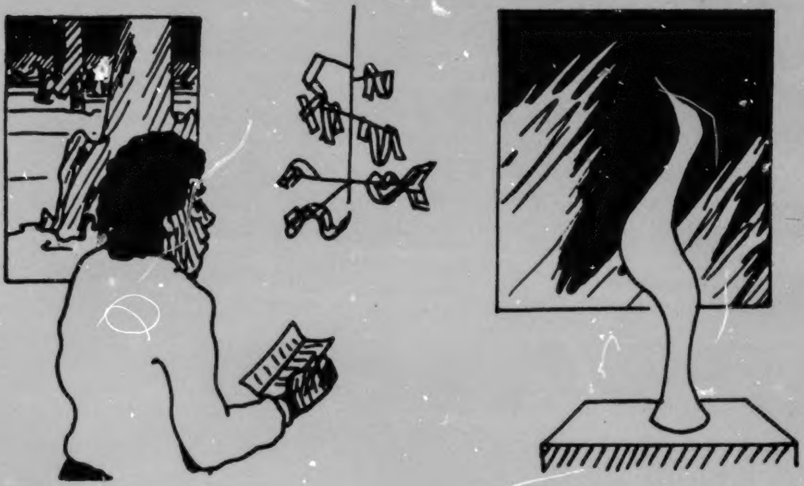


8

Arts Festival

OBJECTIVE

The strong feelings people have about things often inspire great art. If you really love or hate something, that feeling can usually be expressed in an art form. In this activity you and others will create expressions of feelings about a wetland. All art will be displayed at an arts festival.



BACKGROUND

Art is a way of recording how you feel about something. Think about mothers. On Mother's Day you may express your feelings towards your mother with a bouquet of flowers. Maybe you will buy a card with a scene of a landscape or an expressive poem. Maybe you will buy or make her a gift. The gift will be a reminder of the bond between the two of you.

In a similar way, you can express your feelings about a natural environment you have come to know. You might create and dedicate a piece of art to a mountain, a tree, a bird, a pond. The art may be a painting, a poem, a piece of music, a series of photographs, a sculpture, a story, or a craft. You definitely do not have to be an artist with expert techniques. You need only the desire to express a feeling about wetlands.

THE ACTIVITY

Choose just one wetland in your area to be the subject of the arts festival. This provides everyone with many views of the same subject. Your teacher will participate in the selection of the site. Each person should visit the wetland with the material needed to produce the art. Be sure to create a piece of art that represents true feelings for the subject. A guide sheet in Activity Packet #8 has some ideas for producing the art. It also suggests ways to set up the festival.

SUMMARY QUESTIONS

1. Which of the exhibits of art expresses your personal feelings for the wetland?

2. If you were to judge the exhibits, to which one would you award first prize?

3. What are the basic differences between art and scientific studies about the same subject?

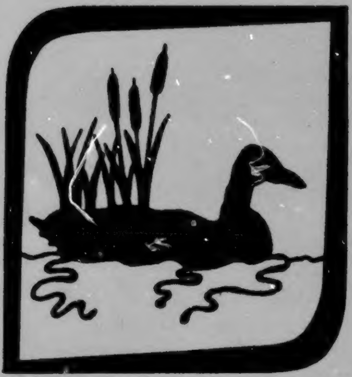
4. Is there any art in science? Where is some? Is there any science in art? Where is some?

GOING FURTHER

1. Make a collection of art that uses wetlands as a theme. You might specialize in painting, photography, poetry, or music.

2. Inquire whether your local newspaper or TV station would be interested in featuring a short series on environmental art. Offer to assist the editor or producer.

3. What examples can you find in art which were influential in swaying public opinion on an issue?



9

Wetlands in Motion

OBJECTIVE

Wetlands are filled with movement. Cattails sway. A venus fly-trap snaps shut. Alligators float by. In this activity you'll learn about the movements of wetland organisms. Then you'll design a body movement activity that represents that movement. You'll learn what purpose there is in this organism's movement.

BACKGROUND

Wetlands appear to be quiet places. If there is anyone at home in this scene, they don't seem to be moving about.

But appearances are deceiving. There is a lot going on in every wetland: organisms swimming about under water; plants responding to sun and wind; birds and other animals coming and going.

Is there any purpose to all this motion? Or are organisms just wandering around? Not at all! Nearly every move that a plant or animal makes has some purpose:

- to catch its dinner;
- to run from an enemy;
- to keep its body warm;
- to soak up sunlight to grow with;
- and so on.

In this activity you'll have a chance to "be" a wetland organism for a while. You'll move the way it moves. Through your movement, you'll show something about the way that organism lives.

THE ACTIVITY

1. Begin by choosing an organism you'd like to learn more about. You have many choices. But if you need some ideas, here's a list to choose from:

Cattails
Great Blue Heron
Mosquito larva
Bittern
Anhinga
Venus fly trap

2. Find out as much as you can about this plant or animal. Pay special attention to the way it moves. How does it get food? How does it travel from one place to another? How does it hide from its enemies?

3. Then make up some body movement that shows how the organism moves. This could be a dance, an exercise, or a body sculpture. If you don't know what these are, ask your teacher. Be very clear about your movements. Someone watching you should be able to tell what you're doing.

4. Perform your body movement for the class. You could work alone or with someone else. You could be two birds building a nest. Or a pair of cattails waving in the wind. Or an alligator chasing a fish. Or something like one of these.

SUMMARY QUESTIONS

1. Make a list of the ways in which your organism moves.

2. For each item on this list, tell what the purpose of the movement is.

3. Are there times when it is important for your organism NOT to move? Explain your answer.

GOING FURTHER

You could get together with five or six others whose organisms live in the same wetlands as yours. Then, all the swampland organisms could design a program about movements in the swamps. Salt marsh, freshwater marsh, and bog organisms could do the same. Then you would have four dance programs or plays about movement in the wetlands.

10

Endangered Wetlands

OBJECTIVE

Our swamps are in danger. So are our marshes and bogs. In this activity, you will see why our wetlands are endangered. You will find out how people want to use them in different ways. Then, you will decide what should be done--if anything--to save them.

BACKGROUND

What good is a wetland? Before going on, write down your answer to that question in the space provided below. Tell what value you think a wetland has just as it is. If you need some ideas, refer to Chapter III in Our Nation's Wetlands.

Some people feel that wetlands have no value. They would like to fill them in. Swamps make more money if homes are built on them. People would like to drain marshes. Dry marshes make good farmlands.

Most wetlands in the United States are in danger. People are arguing about the best way to use swamps, marshes, and bogs. Some want to leave them the way they are. Others want to change them in some way.

There probably is an endangered wetland near you. In this activity you can learn more about that wetland. You will find out what plans people have for it. Then you can decide what you think should be done.

THE ACTIVITY

1. You will need expert help for this lesson. Your first job will be to find someone who knows a lot about wetlands. You could try contacting the following:

- A city or county conservation officer
- A county farm agent
- A member of the local environmental protection agency
- Someone from a conservation organization, like the Sierra Club or the Friends of the Earth
- A college or high school teacher of ecology or environmental science
- Someone from a Federal agency interested in wetlands or in conservation. Persons working at the Soil Conservation Service, National Park Service, U.S. Fish and Wildlife Service, Army Corps of Engineers, or the Environmental Protection Agency might be helpful.
- A land developer, landfill operator, marina owner, lawyer, or anyone who has experience in converting wetlands areas.

Your teacher will have more ideas.

2. Appoint three students to contact your expert. Here are questions you need to ask the expert:

a. Are there endangered wetlands in your area?

b. Will she/he lead your class on a field trip there?

3. You probably will get a "yes" answer to both questions. Then, have your committee arrange a field trip. Some guidelines for the field trip are in Activity Packet #10.

4. Maybe your expert will say "no" to the first question. But she/he may still be willing to talk about wetlands to your class. If so, plan a class visit for the expert. She/he may have slides or pictures of endangered wetlands. If so, then you can still use some of the Guidelines from the Envelope.

SUMMARY QUESTIONS

1. List five ways in which a wetland could be used.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

2. Tell one good thing and one bad thing about each item on your list.

____

____

____

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3. Suppose Mrs. A would like to save a bog for bird-watching. Mr. B would like to cover over the bog for farmland. Is Ms. A a good person or a bad person? Is Mr. B a good person or a bad person? Explain your answers in each case.

Ms. A: Good or Bad? ____________ Why? ________

____

Ms. B: Good or Bad? ____________ Why? ________

____

(Note: After you answer this question, be sure to read #1 under GOING FURTHER.)

GOING FURTHER

1. "Good" and "bad" are probably not proper terms to use in question #3 above. Why? Try re-writing this question so that it deals with the things we really want to know about the use of bogs.

2. You probably know a lot about endangered wetlands in your area. Maybe you know more than most other people. You could prepare an informational pamphlet about the wetlands for friends and neighbors. You could start by describing the wetlands. Then, you could tell how those wetlands could be used in the future. Finally, you could list arguments for keeping the wetlands as they are and for changing them. Think of various ways to print and send out your pamphlet.

11

The Mosquito Wars

OBJECTIVE

Should mosquitoes be exterminated? Or should we try to live with them--suffering from their diseases and poisons? In this activity you will learn about the biology and medicine of mosquitoes. You will also have a chance to investigate mosquitoes and decide how bad these animals of the wetlands really are.

BACKGROUND

The female adult mosquito is a blood sucking insect. Her saliva prevents the clotting of blood while she drinks. This saliva causes swelling and itching in our skin. Sometimes mosquito saliva has germs that cause serious disease. Such diseases as malaria and yellow fever have changed human history. Even ordinary biting mosquitoes influence where people can live comfortably.

Mosquitoes live in wetlands. Many people relate their unpleasant experience with mosquitoes to wetlands. They dislike wetlands as much as they dislike mosquitoes.

It seems that humans and mosquitoes have been at war since ancient times. Mosquitoes can be controlled in various ways. As flying adults they can be poisoned with chemicals or repelled by lotions that cover the skin. As larvae they can be suffocated by oil sprayed on water or eaten by fish and other predators. Their breeding grounds can be dried out by draining wetlands.

Some ecologists worry about our efforts to get rid of mosquitoes. They fear we may change or damage the entire environment in which mosquitoes live. A lot of insect research is looking for ways to solve this problem. We'd like to get rid of the insects without damaging the environment.

THE ACTIVITY

Activity Packet #11 contains a 5-page study guide. Page 1 describes the inside and outside of the body of the female mosquito. There's also information about the mouth parts of the female mosquito. Page 2 is about the life of a mosquito as it develops from egg to adult. Page 3 describes the diseases which mosquitoes carry. You are invited to investigate five diseases carried by humans. Page 4 is about some ways humans try to control mosquitoes. Page 5 has questions about what we should do in our continuing battle with mosquitoes. Should they be eradicated? Or can we learn to live with them under certain circumstances?

Each picture of the study guide includes questions to be answered and pictures to be studied. You may have opportunities to study live mosquitoes or see the operations of mosquito control first hand.

Activity Packet #11 also includes a copy of the article, "The Malevolent Mosquito." This paper may help you answer some of the questions about mosquitoes. It may also give you some additional ideas for your own research.

SUMMARY QUESTIONS

1. How is the mosquito different from all other animals you know?

2. "Mosquitoes have arrested civilizations." What is the meaning of that statement?

3. Humans are so much more powerful than mosquitoes. So why haven't we totally eradicated them as we have the passenger pigeon and some species of mammals?

GOING FURTHER

1. Catch a mosquito. Spread the animal out and make a microscopic slide of it. Carefully draw a detailed picture of its mouth parts.

2. Collect some mosquito larvae and pupae. Keep them in a clear jar with the same water they were living in. Record their change from one life cyle stage to another.

3. Let a mosquito bite you on the forearm. Watch carefully everything the insect does as she takes her meal. How many seconds did she take to fill the crop in her abdomen? At what stage did you feel her presence on your arm?

4. Visit your local Board of Health. Find out what your public health officers do to control mosquitoes in your community. How do they feel about chemical pesticide sprays? Oil on breeding waters? Draining breeding waters? What experiments are they carrying out?

5. How do adult men and women differ in their responses to the choices presented on guide sheet five?

12

What Do You Think of That?

OBJECTIVE

"They're going to fill in Mulligan's Swamp. What do you think about that?" Not everyone knows the wetlands around them very well. Even if they do, they may not care what happens to them. In this activity, you'll find out how much your neighbors know about wetlands where you live. Then you'll see what they think about changes planned for those wetlands.

BACKGROUND

There are wetlands in almost every community. It could be the U Street Swamp, Castle Hill Marsh, or Benson's Bog. In almost all cases, some people have ideas about changing these wetlands. Farmers would like to fill them in. Developers want to build houses on them. The state wants to make a highway through them. It's usually hard to know whether to change a wetland or leave it the way it is.

Good decisions are made only if people are informed. Citizens need to know where wetlands are, what purposes they serve, what will happen if they're destroyed. Only then can they decide if Mulligan's Swamp should be filled in or not.

In this activity you'll find out how much your neighbors know about wetlands in your community. You'll see what ideas they have about changing those wetlands. You might have to do some teaching about wetlands along the way! In the end, you should decide whether the future of your wetlands is well-planned or not.

THE ACTIVITY

1. Choose twenty people to interview. They should include:
   - 5 men over thirty
   - 5 women over thirty
   - 5 men under thirty
   - 5 women under thirty

You can work with a friend on these interviews.

2. Choose a wetland in your area to ask about. If you don't know one, get some help from other sources. Ask your teacher or someone in city or county government. If there is not wetland near you, use the make-believe case study enclosed in Activity Packet #12.

3. Find out if there are any plans to change the wetland. Does anyone want to fill it in, dredge it, or change it in some other way? If so, find out the details of their plans. If not, make up an imaginary situation in which that wetland might be changed for some purpose (new farmland, new housing development, new highway, or new canal, for example).

4. Make up a questionnaire to use with people you've chosen to interview. We've given you a model to start with. It is also in the envelope. You may want to change this model to fit your own situation.

5. Record the results of your survey on the Data Sheet. Finally, combine the results of everyone's interviews. You'll end up with a total class summary.

SUMMARY QUESTIONS

1. From your results, do the people you interviewed seem to know about the wetlands around them? Are the class results about the same as yours on this question?

2. Have the people you interviewed thought about changes that might be made in their wetlands? Do they want to save those wetlands? Do they seem to care what happens to the wetlands?

3. Do the men you interviewed differ from the women you interviewed on these two questions? Do younger people differ from older people?

GOING FURTHER

1. Your local newspaper, radio, or television station might be interested in this survey. Your class could write a news release telling about your results. Then you could send it out to the news media.

2. How do you feel about what you learned in this activity? Are people well informed? Do they have good ideas about wetlands? Maybe you'd like to change this. Maybe you'd like to teach people more about wetlands. Or you might want to change their opinions. If so, design an advertising campaign that will do this. Think of ways to use posters, T-shirts, bumper stickers, news handouts, flyers, or other ways of getting your message to the public.

Glossary

Adaptation	A change in the structure or function of an animal or plant which helps it to be better suited to its environment.
Aerobic	With oxygen.
Anaerobic	Without oxygen.
Bedrock	Solid rock beneath the soil.
Decomposers	Organisms, such as bacteria and fungi, which feed on plant and animal material, breaking it down into simple chemical compounds.
Ecology	The study of the interactions of organisms with each other and with their physical surroundings.
Emergent plants	Plants whose roots are under water, but part of the plant stands up and out of the water.
Endangered	Species whose food sources, habitats, and lives are in danger of destruction by human activity.
Environment	The living and non-living surroundings of an organism.
Eradicated	Having been completely and deliberately wiped out, completely destroyed.
Estuary	A semi-enclosed body of water where fresh water from land meets salt water from the ocean.
Exterminated	Having been completely and deliberately wiped out, completely destroyed.
Extinction	The death of a kind or organism [species].
Fungus	The group of plants with no leaves, flowers or green color reproducing by means of spores; examples include modls and mushrooms.
Indicator	Organisms which signal a change in environmental conditions by either rapidly multiplying, changing color or dying out.
Isotherm	A line on a map which connects points having the same temperature.
Larva	A growth stage, in some animals, which does not look like the adult form.

Niche	The physical space occupied by an organism and the functional role of an organism in a community.
Paleontologist	A person who studies prehistoric life forms through plant and animal fossils.
Photosynthesis	The process in whicn plants use the sun's energy to convert CO_2 and water into food.
Wetland	An area in which the ground is covered with water at least part of the year.
Zooplankton	Microscopic animals found swimming or floating near the surface in oceans and lakes.

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ACTIVITY PACKETS

Chapter 1 - Introduction To Wetlands - None

Chapter 2 - Puzzling Out the Wetlands
    hidden word puzzle
    three wetland scenes

Chapter 3 - The Field Trip
    field trip task cards 1-12

Chapter 4 - Knowing the Organisms
    flash cards 4-1 to 4-16

Chapter 5 - Ecological Niches in the Wetlands
    niche mysteries 5-1 to 5-8
    create an organism 5-9
    create a niche 5-10

Chapter 6 - The High Cost of Eating - None

Chapter 7 - Soaking up Water
    data sheet 1 and 2
    activity sheet 7-1

Chapter 8 - Arts Festival
    activity sheets 8-1 to 8-2

Chapter 9 - Wetlands in Motion - None

Chapter 10- Endangered Wetlands
    field trip guidelines

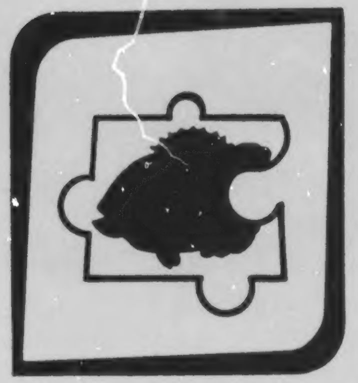
Chapter 11- The Mosquito Wars
    activity sheets 11-1 to 11-5
    newspaper article 11-6 to 11-8

Chapter 12- What Do You Think of That?
    activity sheets 12-1 to 12-4

No Activity Sheets For This Chapter

Puzzling Out the Wetlands

Chapter 2
Activity Sheets

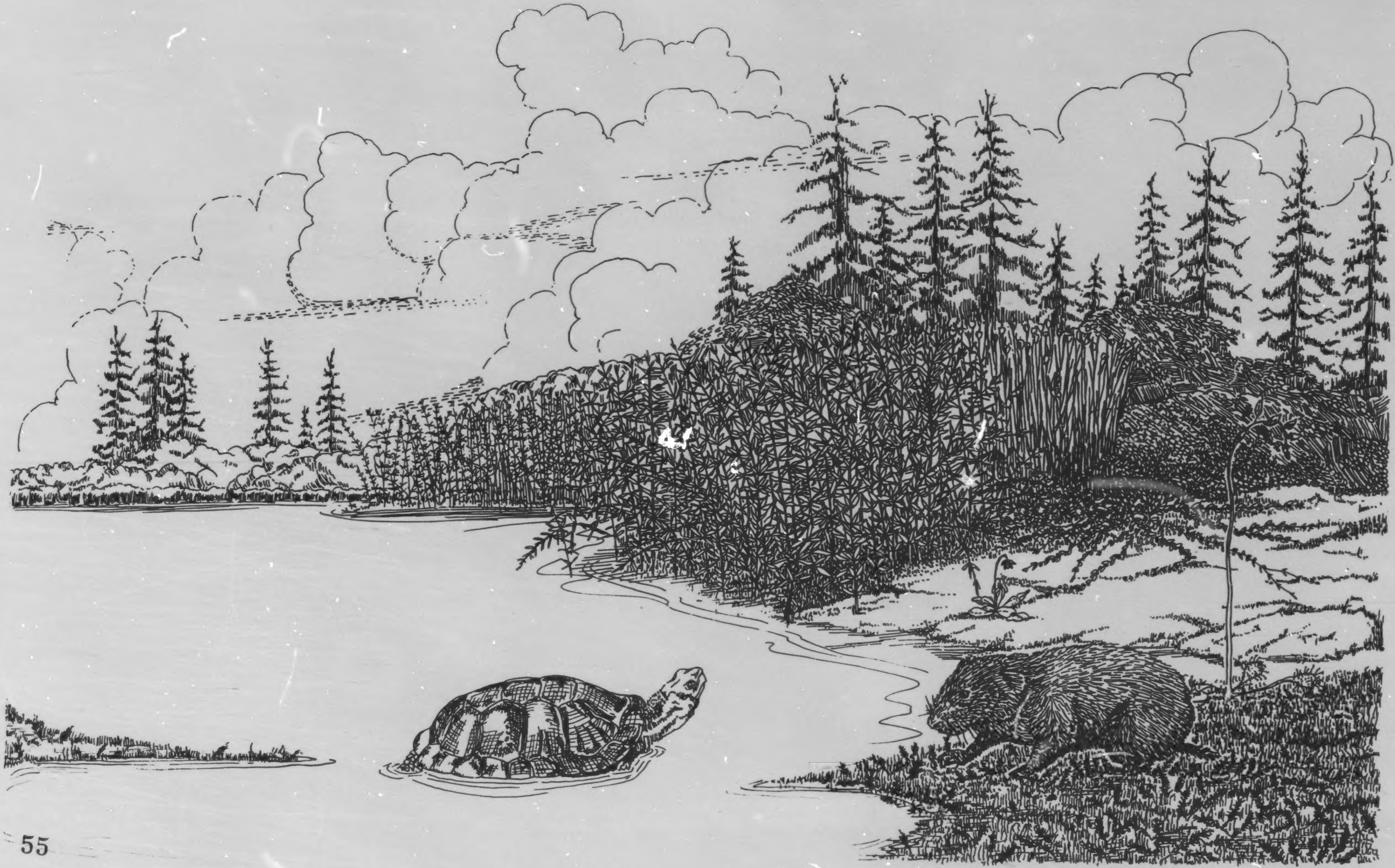


Activity Packet 2

Hidden Word Puzzle

F	V	E	N	U	S	F	L	Y	T	R	A	P	P	R	M	S	E	D	G	E	O	A	T	Z
K	D	S	B	A	L	D	C	Y	P	R	E	S	S	E	I	L	T	J	A	N	C	P	F	R
T	O	M	U	B	Z	B	R	T	S	V	C	G	L	A	S	S	W	O	R	T	Y	I	M	A
N	F	S	A	L	I	M	A	R	S	H	M	O	S	Q	U	I	T	O	A	I	L	T	E	L
K	I	H	B	U	M	I	N	C	H	C	A	T	T	A	I	L	A	E	L	C	G	C	H	L
L	D	P	Q	E	T	X	B	M	X	U	Z	P	E	T	R	S	U	N	F	I	S	H	R	I
R	D	R	J	H	E	H	E	O	N	A	M	L	T	J	O	M	T	M	C	J	A	E	C	G
X	L	Z	R	E	M	N	R	S	T	U	T	D	Y	B	D	N	G	L	P	R	S	R	N	A
Y	E	O	M	R	K	I	R	P	A	R	R	O	W	A	K	U	M	P	E	R	K	P	J	T
A	R	C	K	O	S	O	Y	S	U	N	D	E	W	N	B	R	O	O	W	C	N	L	E	O
E	C	T	H	N	A	N	B	T	R	O	W	N	E	T	Z	A	W	B	U	C	K	A	C	R
E	R	E	D	W	I	N	G	E	D	B	L	A	C	K	B	I	R	D	L	T	I	N	D	R
T	A	F	O	E	L	O	P	O	E	P	E	H	T	E	W	H	D	G	S	M	H	T	T	A
H	B	E	U	N	B	I	T	D	U	C	K	W	E	E	D	O	E	D	S	T	A	T	E	S
C	E	F	R	B	D	E	R	O	M	A	M	R	O	F	O	O	T	R	E	D	R	O	N	I
S	A	N	D	H	I	L	L	C	R	A	N	E	T	W	T	U	N	I	O	N	E	S	T	A

Fiddler Crab
Bald Cypress
Alligator
Cranberry
Red-Winged Blackbird
Sunfish
Saltmarsh Mosquito
Duckweed
Sandhill Crane
Cottonmouth
Blue Heron
Arrowarum
Woodduck
Venus Fly Trap
Sundew
Sedge
Cattail
Glasswort
Bogturtle
Pitcher Plant

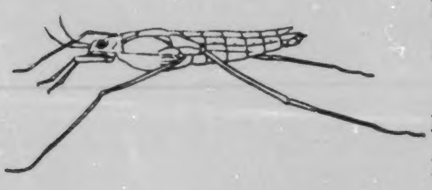


The Field Trip

Chapter 3
Activity Sheets

Activity Packet 3
Field Trip Task Card 1

Scavenger Hunt in the Wetlands



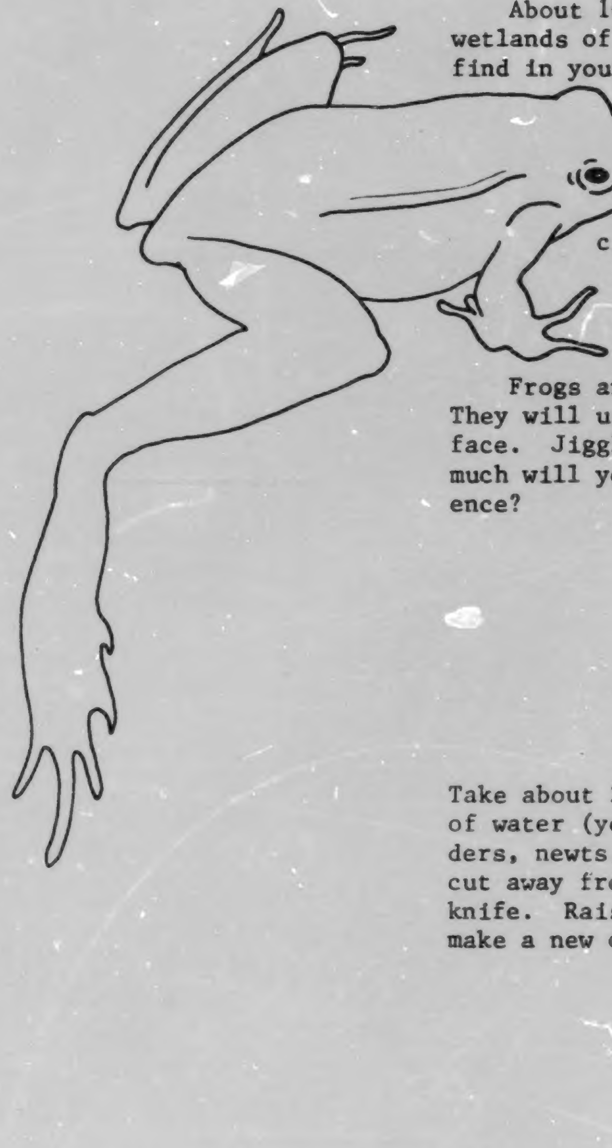
How many of the following items can you collect in 30 minutes? Search for these items by yourself, in competition with a friend, or in teams of two or three. Carry your collection in plastic bags. Live aquatic insects should be kept in containers with water.

1. One land insect
2. One aquatic insect
3. An object showing evidence of a bird
4. An object showing evidence of humans
5. An object showing evidence of a nonhuman mammal
6. An object showing evidence of a fungus
7. A leaf from an emergent plant, one that grows out of water.
8. A leaf from a floating plant
9. A leaf from a submergent plant, one that grows beneath the water.
10. A leaf from a land plant
11. A seed
12. A sample of (anaerobic) mud with odor of rotten eggs
13. A sample of (aerobic) mud with a clean odor
14. A sample of bedrock

If you don't understand all the above terms, use your Glossary.

Activity Packet 3
Field Trip Task Card 2

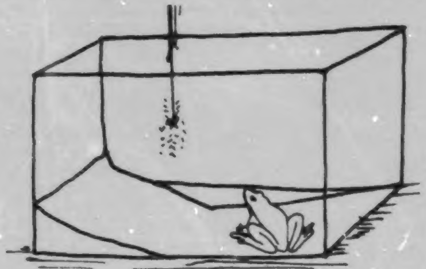
Frogs



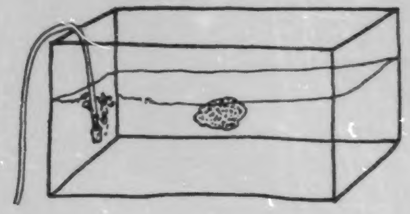
About 100 kinds of frogs and toads live in the wetlands of America. Which species of frog can you find in your area?

In Calaveras County, California there is an annual frog jumping contest. The present world record is 20 feet 3 inches (6.2 meters). This is the farthest from the center of a circle a frog will go in only three hops. You can't touch the frog! How close to the world record do your frogs jump?

Frogs and toads can be kept in aquarium tanks. They will usually eat food dangled in front of their face. Jiggle the string to make the food move. How much will your frog eat? Does it have a food preference?



Take about 20 frog eggs from your wetland in a bucket of water (you may discover that the eggs are salamanders, newts, or toads). Your sample of eggs can be cut away from the much larger mass of eggs with a knife. Raise the young in an aquarium. Each day make a new drawing of a growing tadpole.



And Some of their Relatives

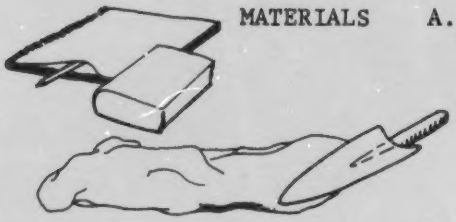
Newts and salamanders are common in freshwater wetlands. There are about 135 kinds in America. They are easily collected with a net that sweeps along the bottom of shallow water. Others can be found in moist areas around the water, particularly under rocks.

Keep newts and salamanders in aquariums. Feed them live mealworms or tubifex worms. This food can be bought in pet stores.

Find a place where you can eavesdrop on a reptile of the wetland. Watch it for as long as you can. Write down everything it does.

Activity Packet 3
Field Trip Task Card 3

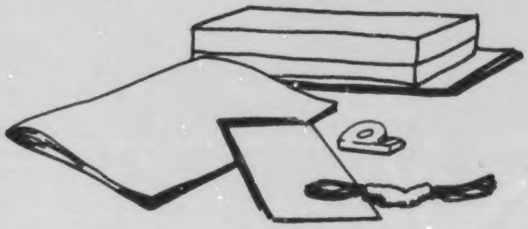
Make a Wetlands Plant Collection



MATERIALS A. For the field trip

1. Plastic bag
2. Trowel
3. Notebook and pencil
4. Guide book to plants

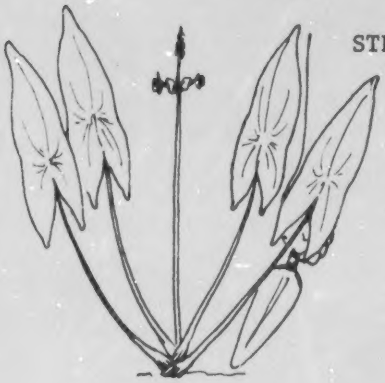
B. For the lab work



1. Two boards 12" x 18" (or plant press)
2. Newspapers
3. Blotter (11½" x 16½" or paper towels)
4. Corrugated ventilators (11½" x 16½")
5. Weights (box of stones or bag of sand) or straps
6. Plant display sheets (11½" x 16½")
7. Transparent tape

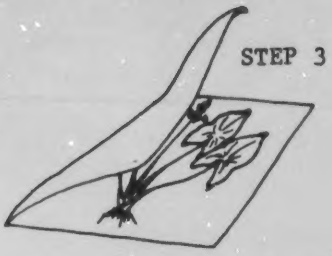
STEP 1 Find a plant that interests you. Find out its name. Write in your notebook things you can observe.

1. What is its name?
2. Where does it grow?
3. What color is it?



STEP 2 Collect the plant - make sure the plant is not rare and protected.

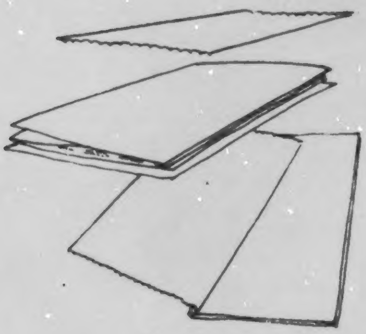
1. Carefully dig or pull the plant out of the soil.
2. Carry it back with other plants in a plastic bag.



STEP 3

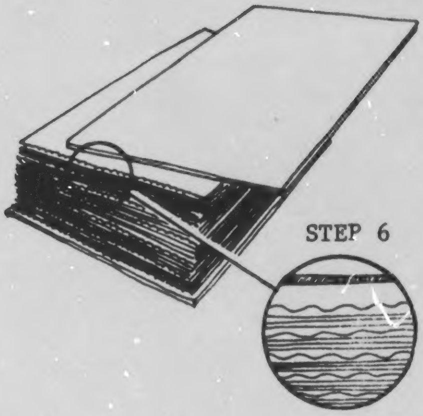
1. Lay out the plant between the halves of a folded newspaper.
2. Add a note with your name, date, where collected, and name of plant if known.
3. Bend part of plant to fit 11½" x 16½" size.

STEP 4



Place blotter driers, paper toweling, or more newspaper under and on top of folded newspaper.

STEP 5

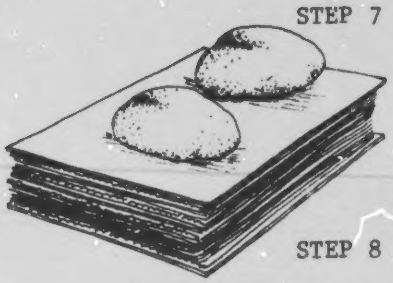


1. Place corrugated cardboard sheets above and below the blotter driers.
2. Place this stack on the board that forms the bottom of the press.

STEP 6

Continue to add blotter, specimens in newspaper, blotter, corrugated cardboard sheet, blotter, etc., until you have a stack no larger than ½ meter.

STEP 7

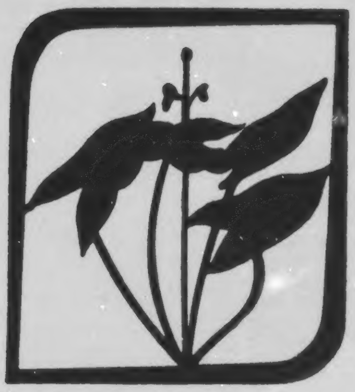


1. Place top of press on stack.
2. Add weight (box of stones, bag of sand) or strap the press together.
3. Change wet blotter for dry blotters every day and continue until blotter stays dry.

STEP 8

1. Mount dried plant specimens on sheets of white paper 11½" x 16½". Use transparent tape.
2. Add the label that gives name of plant, location found, date of collection, and name of collector.

You might even make a frame and turn your collection into an art object to hang on the wall.

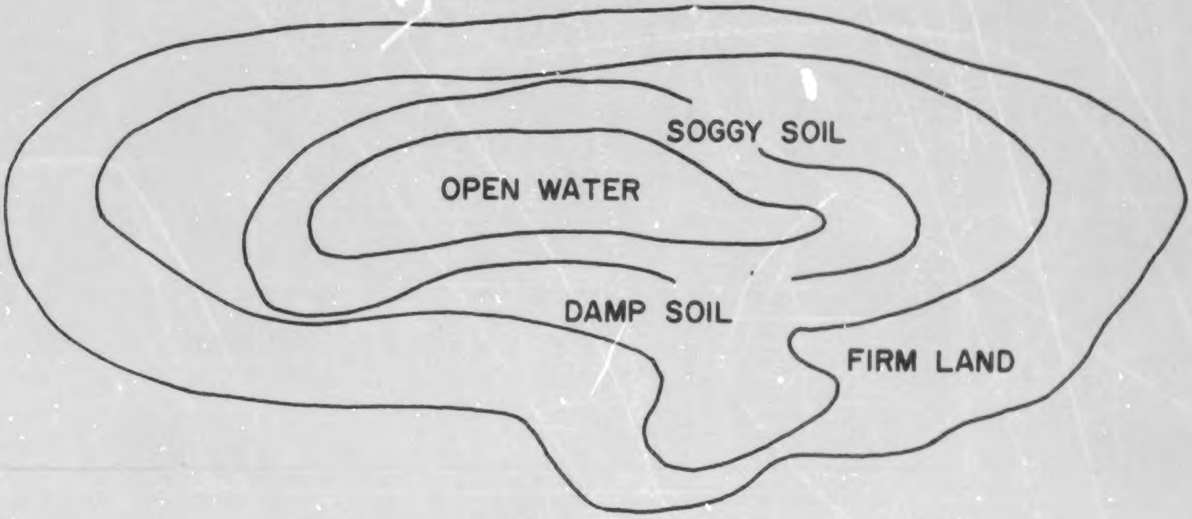


Activity Packet 3
Field Trip Task Card 4

Plant Map

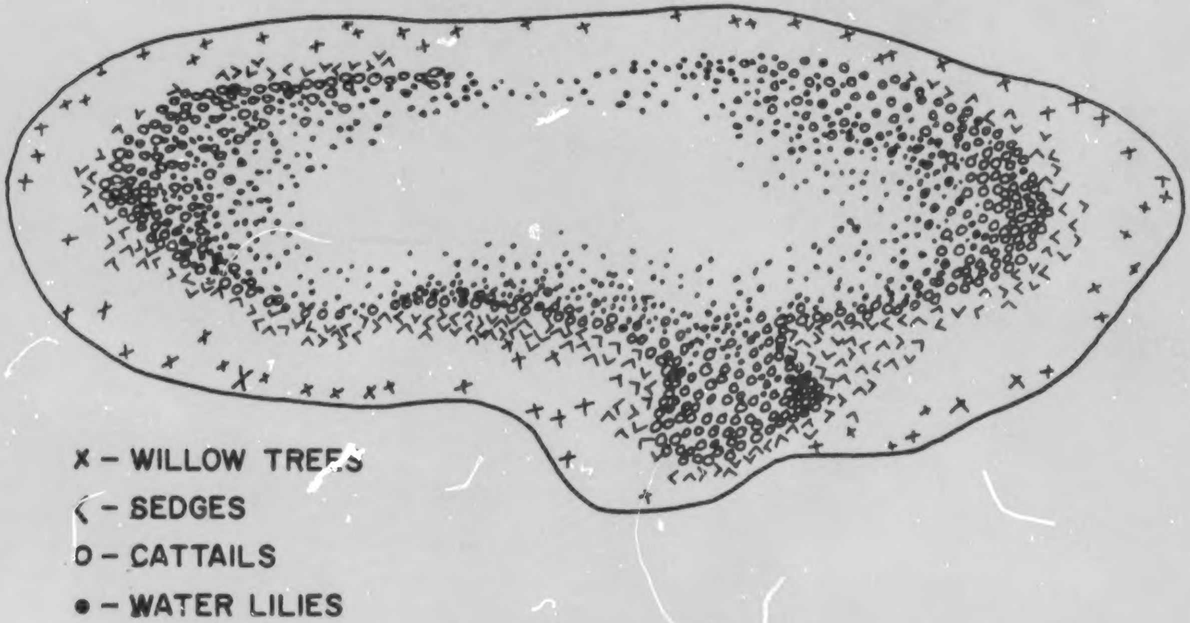
The kinds of plants that grow in wetlands depend on the chemistry of the water and soil, the amount of sunlight received, the air temperature, the water temperatures, the movement of the water. Indeed, wetlands are classified on the basis of where key types of plants grow.

Survey your wetland and make a general sketch of the land types. In this example we see FIRM LAND, DAMP SOIL, SOGGY SOIL, and OPEN WATER.



Here is an example of a sketch. The wetland is viewed from above as if it were a map.

Choose one plant from each land type. Select the plant that seems to be the best indicator of a land type. For example, you may pick cattails for soggy soil, sedges for damp land, water lilies for open water, and willow for firm land. Using dots, X's, circles, or other symbols, make a plant map of the wetland.



QUESTIONS SUMMARY

1. What specific environmental conditions appear to be important to the growth of your indicator plant?

2. How has the growth and distribution of plants been affected by pollution? by sunlight? by weather?

Activity Packet 3
Field Trip Task Card 5

Wet Pets

THE PROCEDURE

Select an organism of the wetland.

Observe the organism.

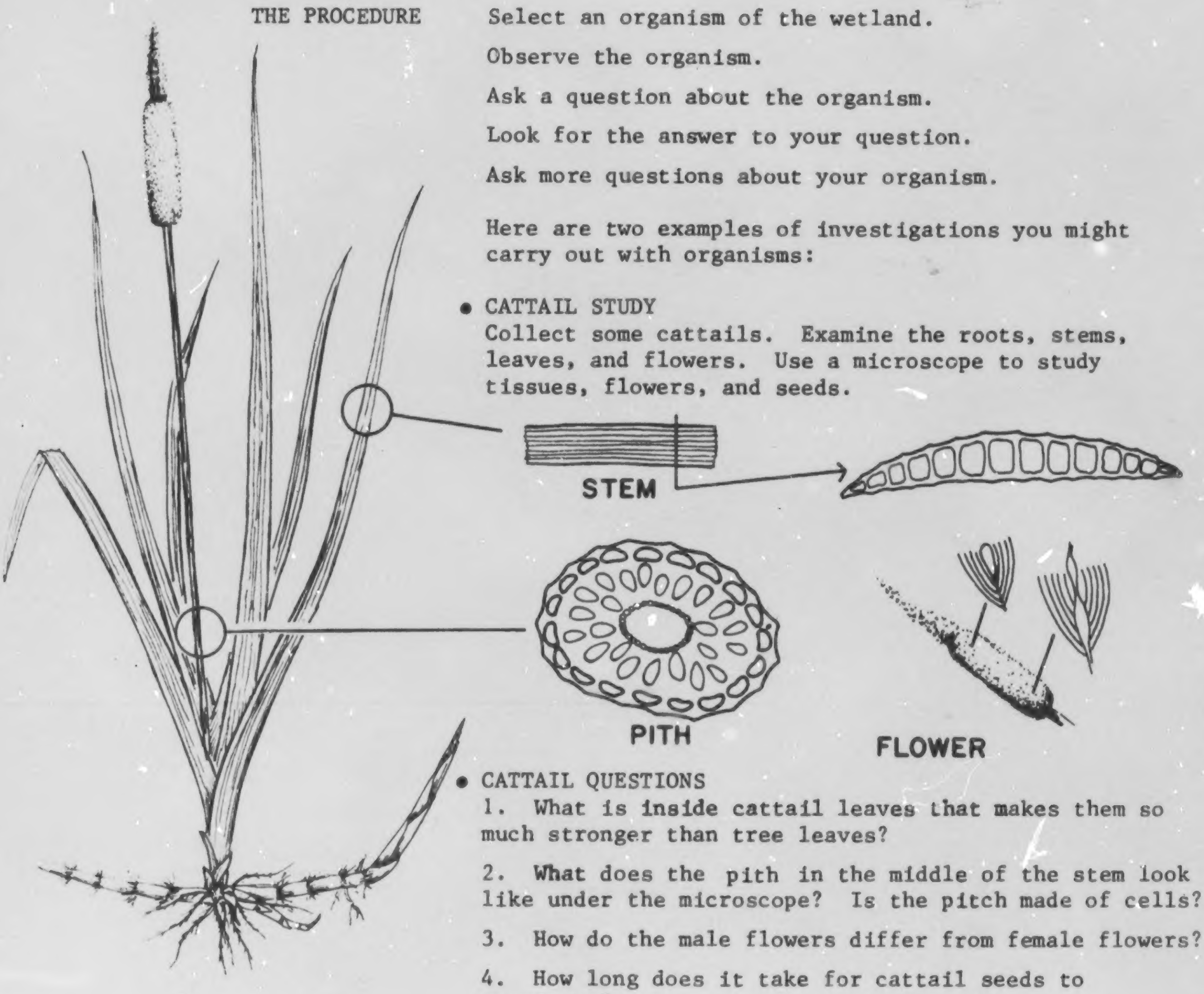
Ask a question about the organism.

Look for the answer to your question.

Ask more questions about your organism.

Here are two examples of investigations you might carry out with organisms:

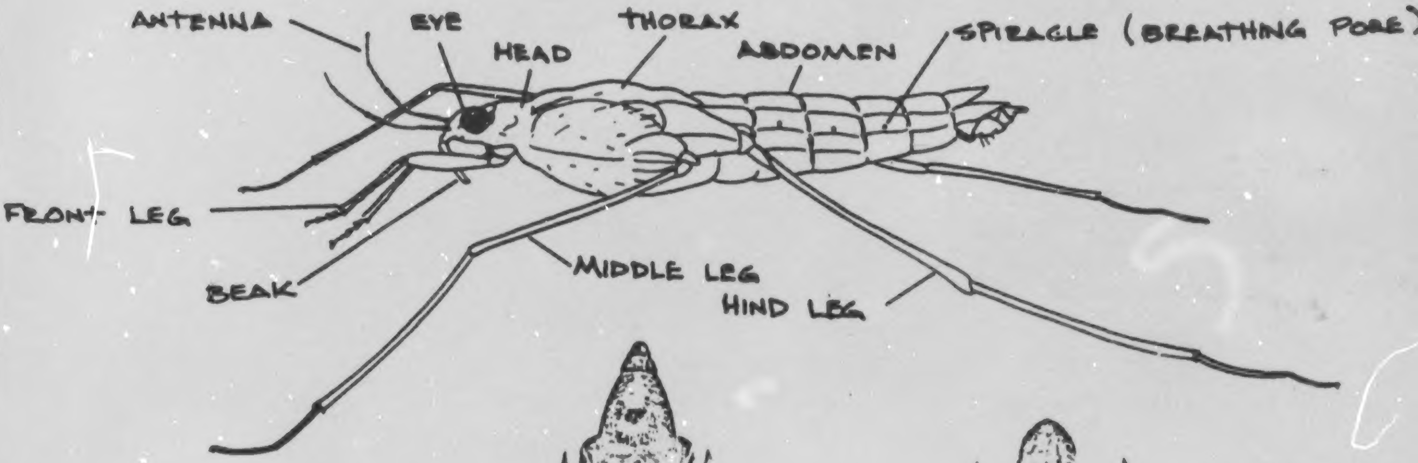
- CATTAIL STUDY
  Collect some cattails. Examine the roots, stems, leaves, and flowers. Use a microscope to study tissues, flowers, and seeds.



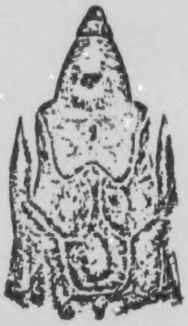
- CATTAIL QUESTIONS
  1. What is inside cattail leaves that makes them so much stronger than tree leaves?
  2. What does the pith in the middle of the stem look like under the microscope? Is the pitch made of cells?
  3. How do the male flowers differ from female flowers?
  4. How long does it take for cattail seeds to germinate?

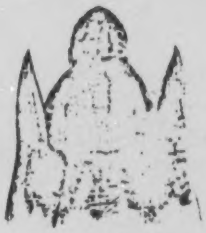
Water Strider Study

Use an insect net to collect some male and female water striders from the surface of a pond. Cover the bottom of an aquarium with wet paper toweling. Add the water bugs. Place a lid over the aquarium.



female parts





male parts

One at a time add different kinds of insects that you have collected from a freshwater wetland.

Water Strider Questions

1. Which insects do the striders eat? Which do the striders not eat?

2. How do the mouth parts of striders work as they feed?

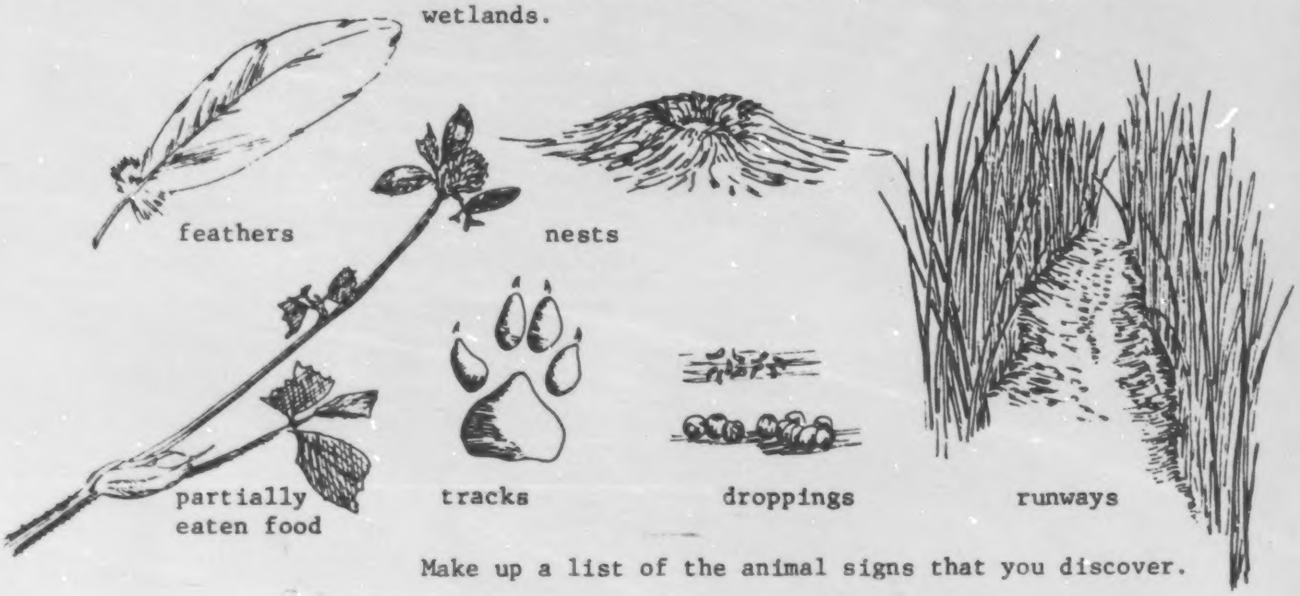
3. How long does it take for the eggs of striders to hatch?

4. How do water striders manage to "float" on the surface of water?

Activity Packet 3
Field Trip Task Card 6

Animal Signs

Look for clues of unseen animals that live in the wetlands.



Make up a list of the animal signs that you discover.

Collect specimens, or draw pictures of the signs in your notebook.

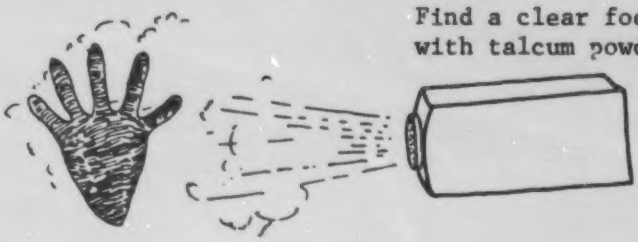
Then see if you can figure out what type of animal created the signs.

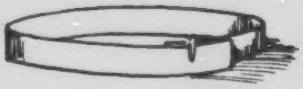
HOW TO MAKE PLASTER CASTS OF ANIMAL TRACKS

Materials

1. Talcum powder
2. Plaster of Paris
3. Plastic bowl
4. Spoon
5. 1" x8" cardboard strip
6. Paper clip
7. Brush

Find a clear footprint of a bird or mammal and dust it with talcum powder.



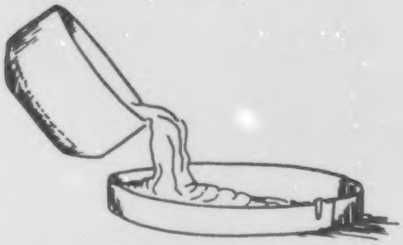


Make a round form by attaching the ends of the cardboard strip together. Hold them together with a paper clip.

Place the round form around the animal track.

Using the bowl and spoon, mix about 2 cups plaster with enough water to make a goop about as thick as pea soup.

Pour the soupy plaster into the cardboard form.



Smooth the plaster on the top to make a flat side.

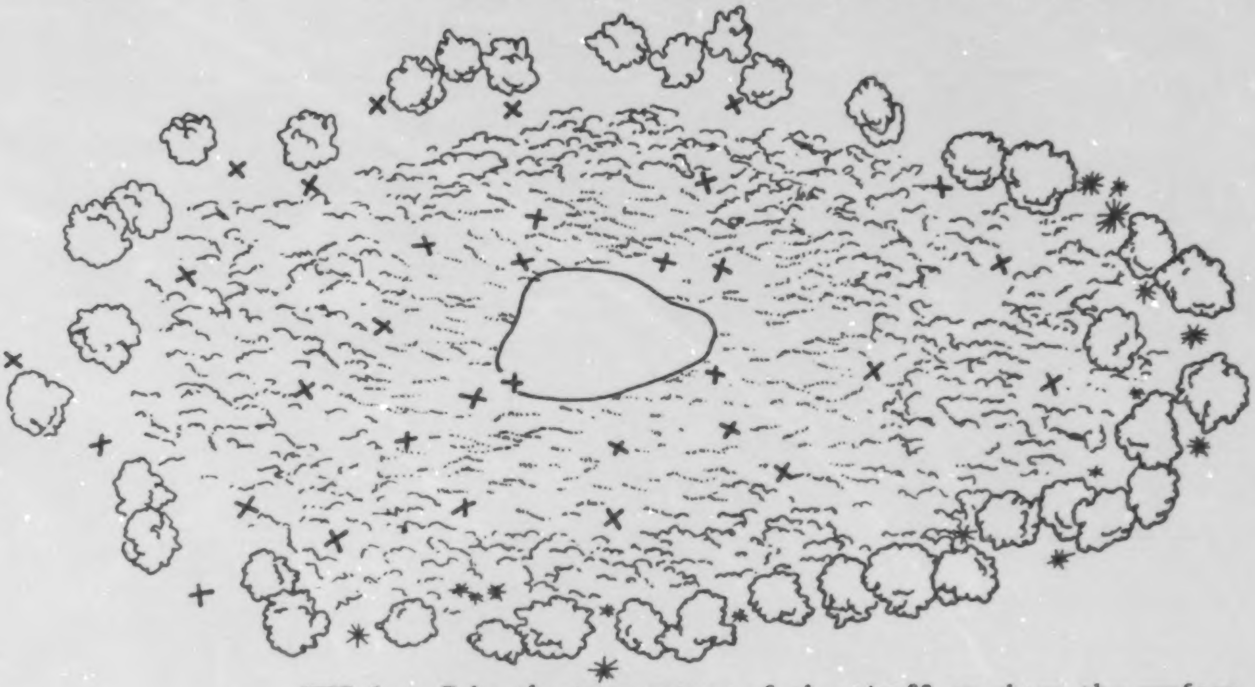
Allow the plaster to harden. Then remove the hardened plaster from the form. Clean the cast of the track with a brush.

Activity Packet 3
Field Trip Task Card 7

Temperature Map

Draw a map of the wetland including some of the high ground and water that may surround the habitat.

HEDMAN BOG Thursday, 14 May 1981, 10:30 hrs.

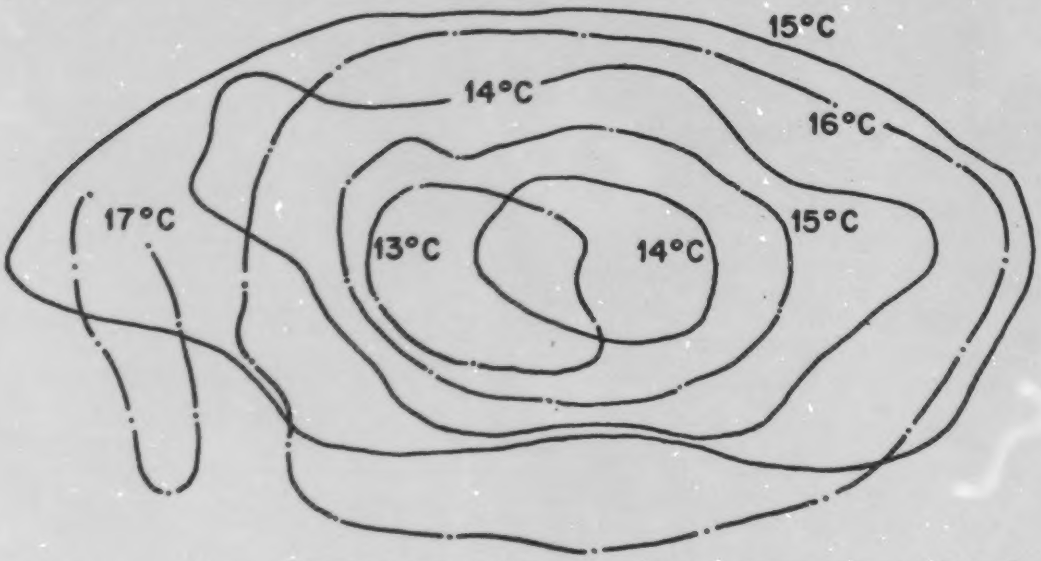


STEP 1 Take the temperature of the air 30 cm above the surface at ten or more locations in each region of the habitat. (In the example of the bog above, readings of air temperatures are taken at locations marked "X".) Record these temperatures on your map in red.

Continue to take air temperatures in other regions of the wetland. Similarly record these temperatures in their corresponding locations on the map.

STEP 2 Using the same thermometer, measure the temperatures of the air at the surface of the ground. Again, take plenty of readings at different locations throughout the wetland. Record temperatures on your map in blue at the location of the readings.

Draw a temperature map of the wetland. Temperature maps attempt to enclose all areas on the map of the same temperatures. The enclosing lines of one temperature are Isotherms. Draw air temperature isotherms at 30 cm above the ground in red. Draw ground-surface air temperature isotherms in blue.



1. What causes differences in air temperatures throughout the wetlands?

2. What do you guess the temperature map of the wetland would be during the night? On a hot cloudless summer afternoon?

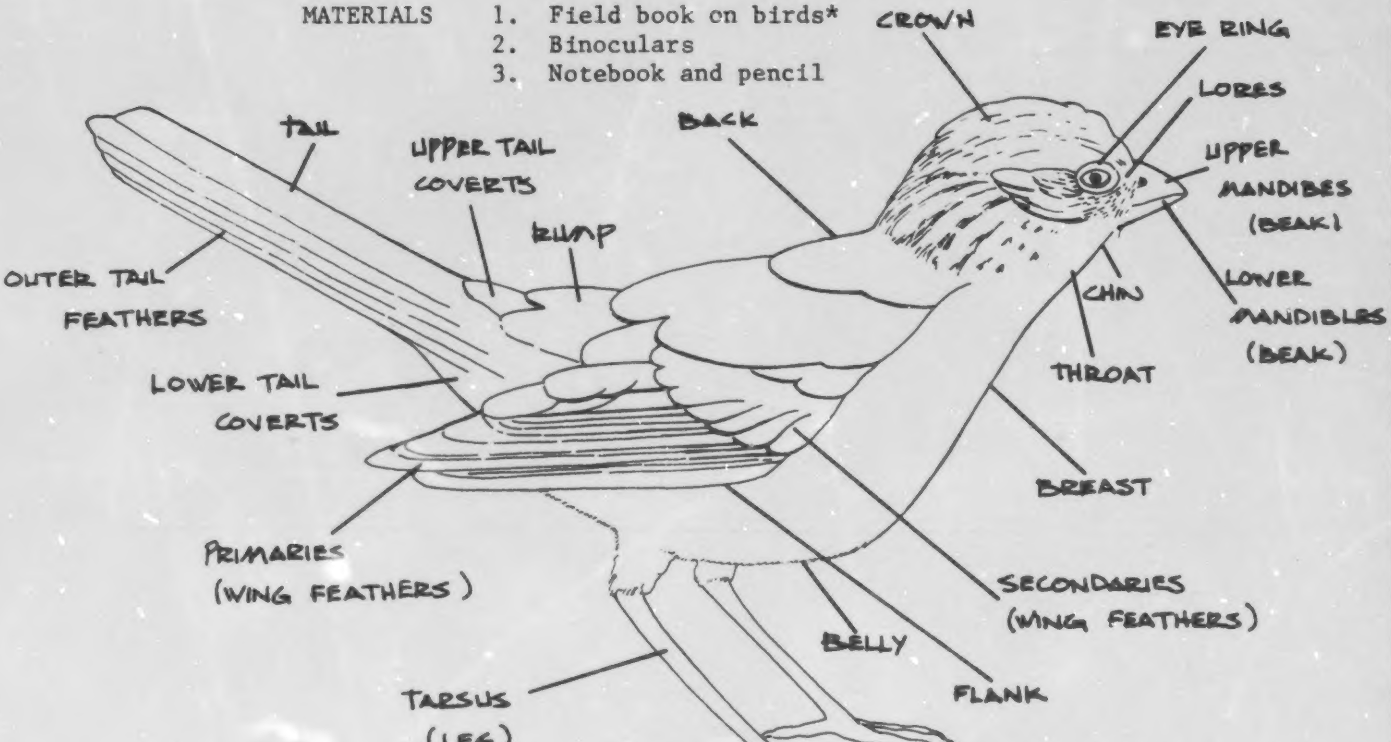
Activity Packet 3
Field Trip Task Card 8

Bird Watching I
Identifying Birds

How many different kinds of birds can you spot in the wetlands?

What are the names of the birds?

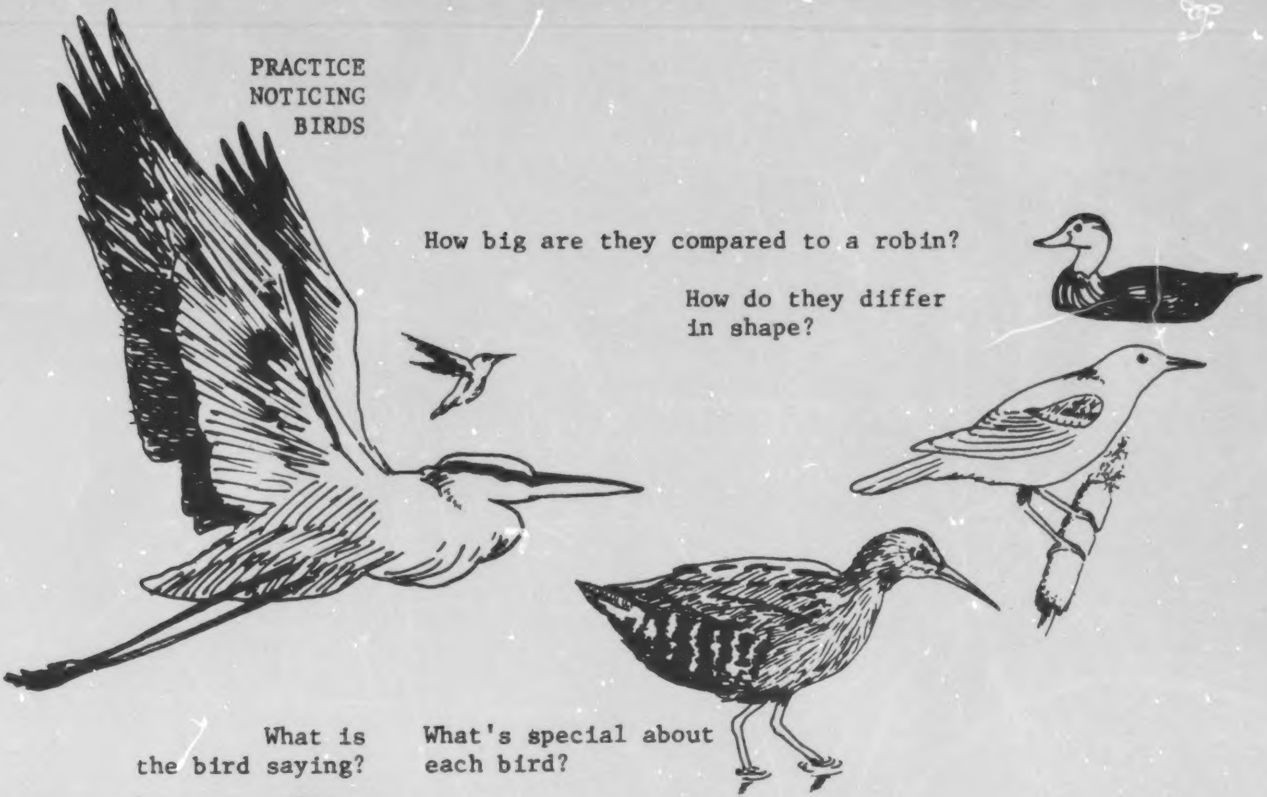
MATERIALS
1. Field book on birds*
2. Binoculars
3. Notebook and pencil



Learn the parts of a bird. Look for these parts on living birds in the outdoors.

*Here are a few suggestions for field books on birds.
1. A Guide to Field Identification. Birds of North America. C. Robbins, B. Bruun, and H. Zim. Golden Press, New York, 1966.
2. A Field Guide to the Birds. Eastern Land and Water Birds. Roger Tory Peterson. Houghton Mifflin Company, Boston, 1947.
3. A Field Guide to Western Birds. Roger Tory Peterson. Houghton Mifflin Company, Boston, 1961.

PRACTICE NOTICING BIRDS



How big are they compared to a robin?

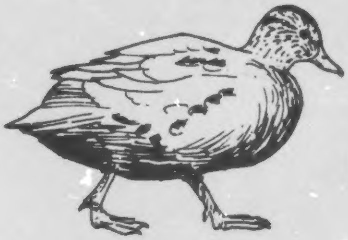
How do they differ in shape?

What is the bird saying?

What's special about each bird?

forked tail

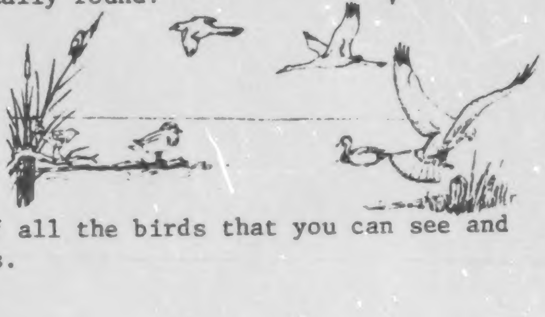
walks in circles



runs up and down a tree

Do they watch you?

Where are they usually found?

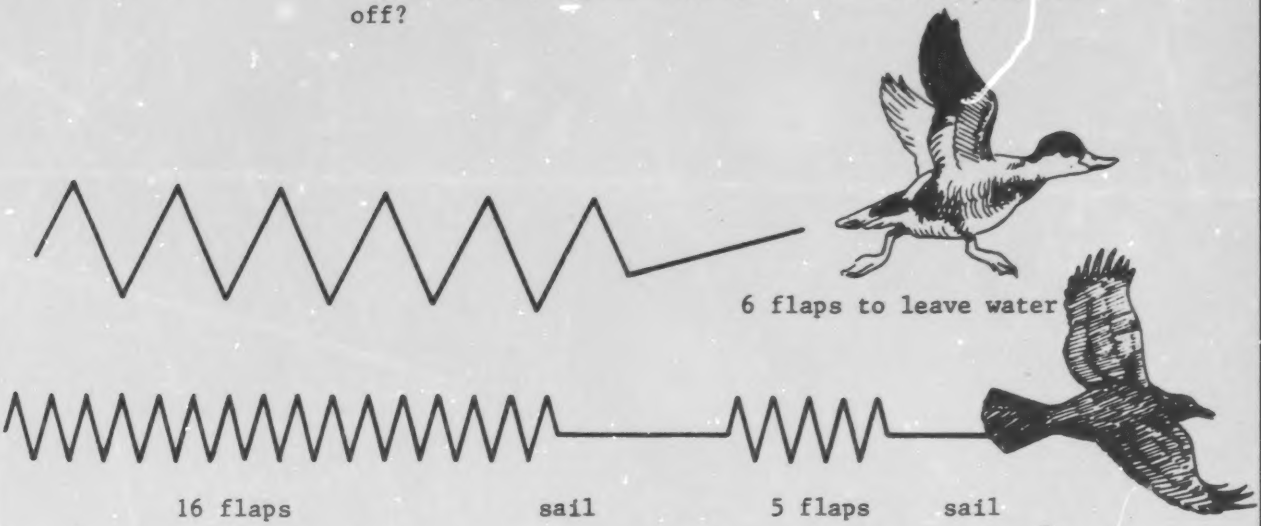


Now make a list of all the birds that you can see and name in 15 minutes.

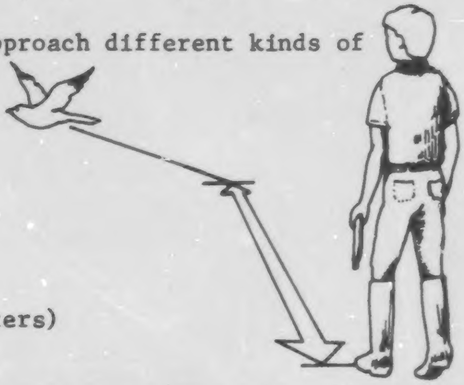
Activity Packet 3
Field Trip Task Card 9

Bird Watching II
Special Bird Study Projects

How do birds in your wetland differ in how they take off?



How close can you approach different kinds of birds before they fly off?



Fright Distance (meters)

Trials

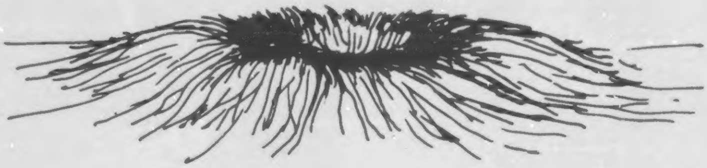
Bird	1	2	3	4	5	6	7	8	9	10	Average
Great Blue Heron											
Redwing Blackbird											

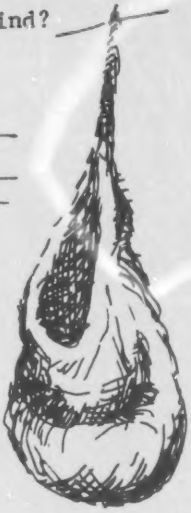
What foods do the birds of the wetland eat?

Draw pictures of the beaks of birds at work catching and holding food in your wetland.

BECOME A
NIDOLOGIST
(a scientist who
studies nests)

How many different kinds of nests can you find?

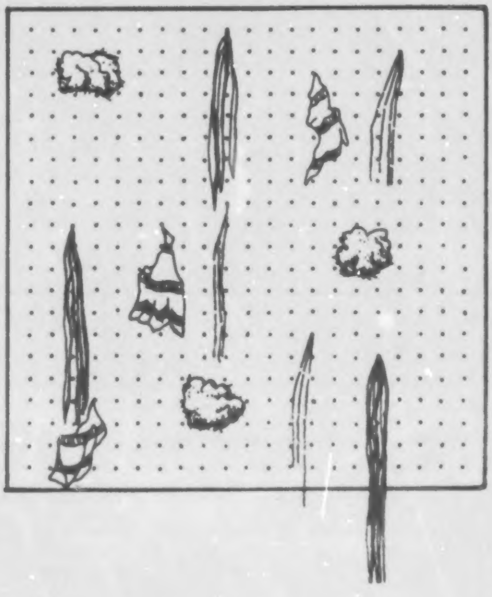




How many eggs, or young, live in one nest?

What are nests made of?

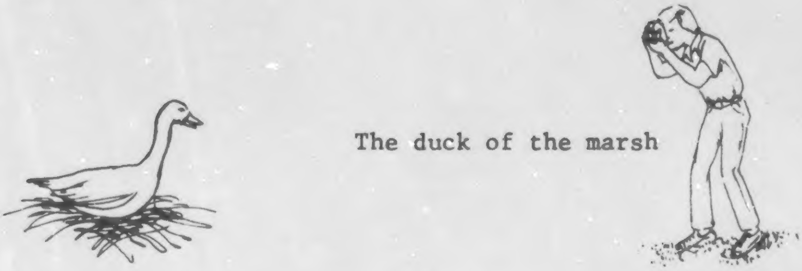
Set out a selection of materials nesting birds might select from. Watch the board with field glasses. Which materials are preferred by which birds.



Activity Packet 3
Field Trip Task Card 10

Photography

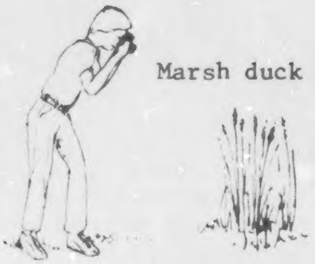
Take a camera to a wetland and shoot the story . . . about an animal.



The duck of the marsh

Tracks of the marsh duck

Marsh duck morsels

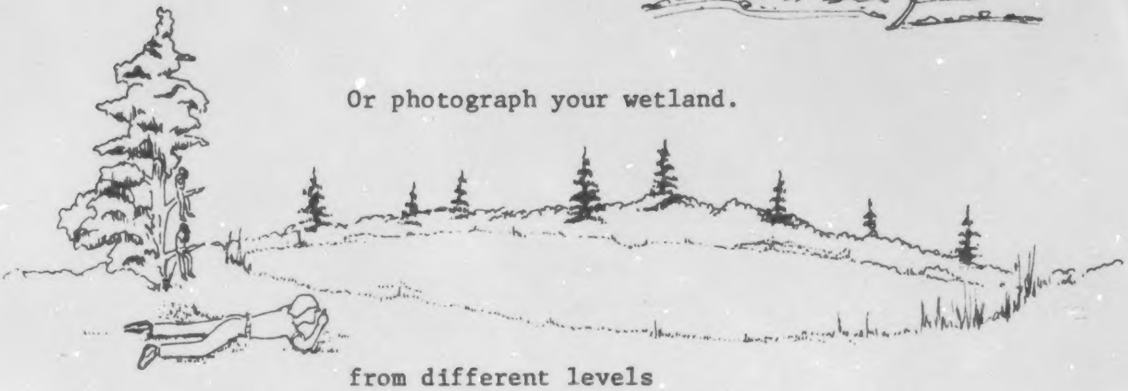


Marsh duck nest

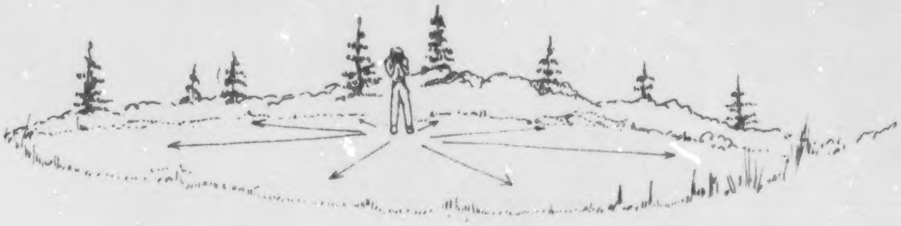
Homeland of marsh ducks

Or tell a story about how plants and animals interact in the wetland.

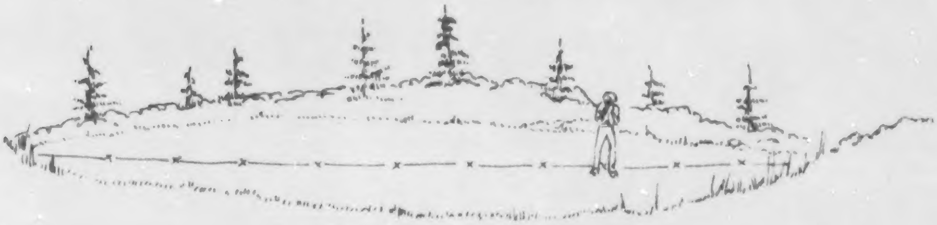
Or photograph your wetland.



from different levels



in all directions around a point



at points along a line

Activity Packet 3
Field Trip Task Card 11

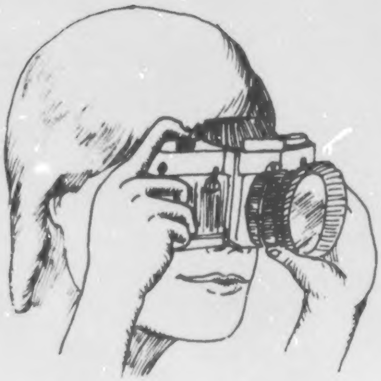
Record an on the spot news broadcast for Station WETS

"Good day Mr. and Mrs. America. This is Jay Kay Caramanico speaking to you from the Yew Street Swamp.

"Today I am going to tell you all about animals and plants I see as I walk around and through the Yew Street Swamp. Later I will talk to Mrs. Pam Doolittle who lives next to this swamp. You may recall that Mrs. Doolittle wrote an angry letter to the Tribune. She's upset about what may happen to this swamp."

HERE ARE SOME MORE IDEAS FOR BROADCASTS

Prepare a TV program about life in a wetland.



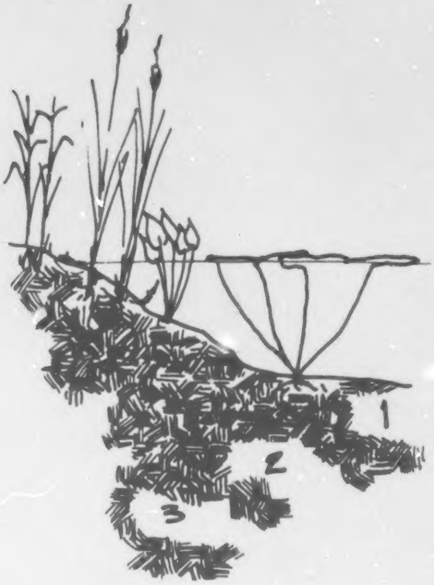
Take some photographs of a wetland. Write a script to go with the pictures. Prepare your own slide/tape show as in Activity #1.

Write a radio play about a strange event that occurred in the wetland.

Interview persons who have different opinions about the importance of the wetlands in your community. Perhaps you can even record a discussion or formal debate.

Activity Packet 3
Field Trip Task Card 12

Mud

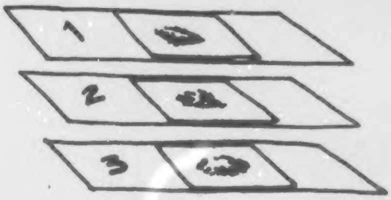


What can a microscope show you about the mud of a wetlands?

Collect samples of mud from three levels:

1. The top of the mud
2. The middle of the mud
3. The bottom of the mud

Make a thin slide of each sample of mud.



Look at each slide under a microscope.

Make drawings of about 3 pieces of mud from each level.

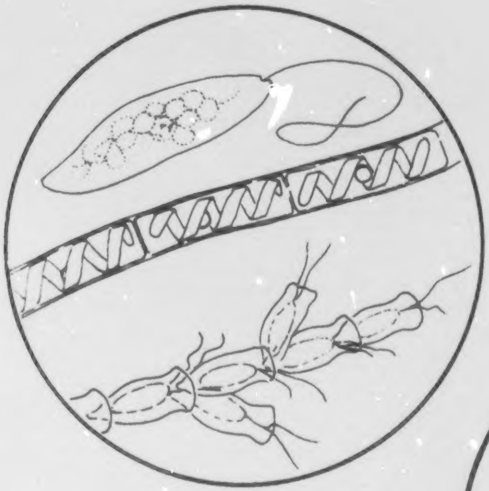
How do samples of mud from the top, middle, and bottom levels differ?

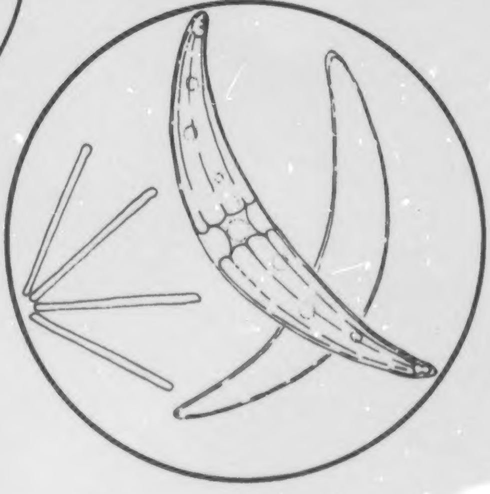
If you mixed all the slides up could you pick out which ones belonged to which level by the contents?

What organisms live in mud?

Use a microscope to explore your samples of mud.

Whenever you see something that seems to be alive, draw a picture of it.

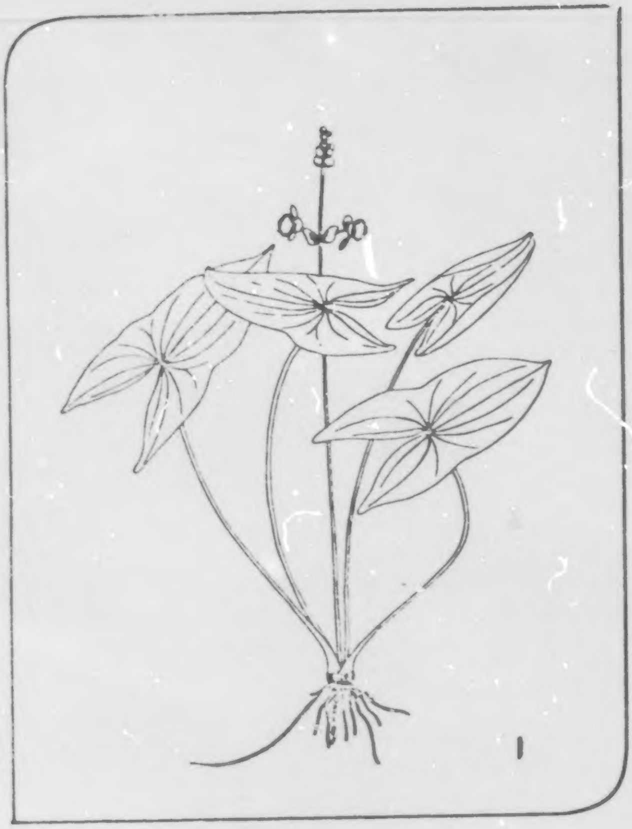




Group your drawings of organisms by color, by shapes, by size, and by the way they move.

Knowing the Organisms

Chapter 4
Activity Sheets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4

CATTAIL
(Typha latifolia)

Fresh Water Marsh

Not Endangered

Did you know that almost every part of the cattail can be eaten? Different parts can be used at different times of the year.

BROADLEAF ARROWHEAD
(Sagittaria latifolia)

Fresh Water Marsh

Not Endangered

Did you know that the tubers of this plant can be boiled and eaten like potatoes?

LONG-BILLED MARSH WREN
(Telmatodytes palustris)

Fresh Water Marsh

Not Endangered

Did you know that the Long-billed marsh wren builds very special kinds of nests? They fasten them to bullrushes two or three feet above the water.

SANDHILL CRANE
(Grus canadensis)

Fresh Water Marsh

Endangered in some areas

Did you know that cranes stay with one mate for life? During mating season, they do some very fancy dances with each other.

5

6

MUSKRAT
(Ondatra zibethica)

Fresh Water Marsh

Not Endangered

Did you know that muskrats build stick houses like those of a beaver? The houses of both animals have underwater entrances.

GOLDEN CANNA
(Canna flaccida)

Fresh Water Marsh

Not Endangered

Did you know that the golden canna lives only in fresh water marshes?

7

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WOOD DUCK

(Aix sponsa)

Fresh Water Marsh

Endangered in some areas

Did you know that the wood duck was thought to be extinct in 1914? We thought they had been killed off by hunters. But they have been saved. Some were imported from other countries. And it is now illegal to hunt them.

RED-WING BLACKBIRD

(Agelaius phoeniceus)

Fresh Water Marsh

Not Endangered

Did you know that the Red-wing Blackbird nests among cattails and rushes? This bird is found in many other places besides wetlands.

WATER STRIDER

(Gerris sp.)

Fresh Water Marsh

Not Endangered

Did you know that the water strider is nocturnal? That means it is active at night. It preys on other insects that live on the water. What place in the food web do you think the water strider belongs?

BULLHEAD

(Ameriurus melas)

Fresh Water Marsh

Not Endangered

Did you know that bullheads can survive in very shallow water? They do so by burrowing in the mud.

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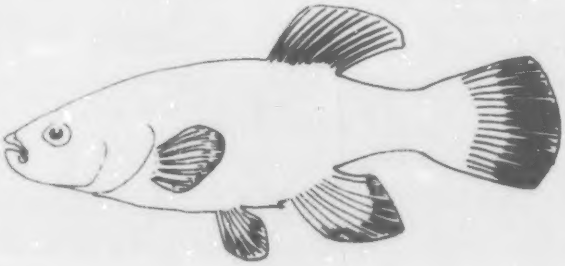

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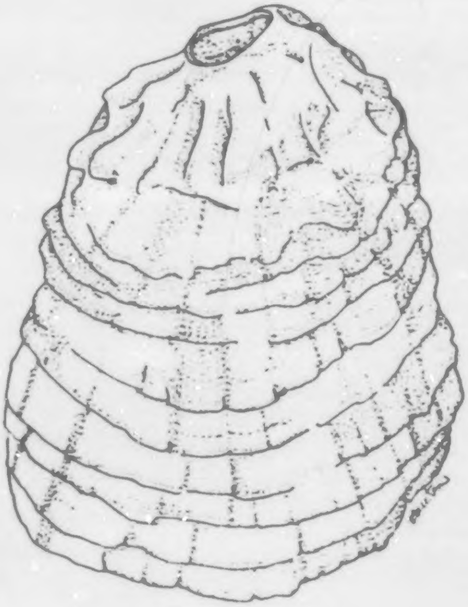

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MARSH FIDDLER CRAB
(Uca pugnax)

Salt Water Marsh

Not Endangered

Did you know that the Marsh fiddler crab is an important link in many food webs? It eats dead organisms from the marsh bottoms. In that way, the dead organisms become part of the food web.

OSPREY
(Pandion haliaetus)

Salt Water Marsh

Rare

Did you know that the osprey is an unusual hawk? It is one of the only hawks that dives into the water for its food.

VIRGINIA OYSTER
(Crassostrea virginica)

Salt Water Marsh

Not Endangered

Did you know that this oyster is commercially important? People like to eat it. So does a small snail called the Oyster Drill. This snail drills through the oyster's shell. Then it sucks out the oyster's flesh.

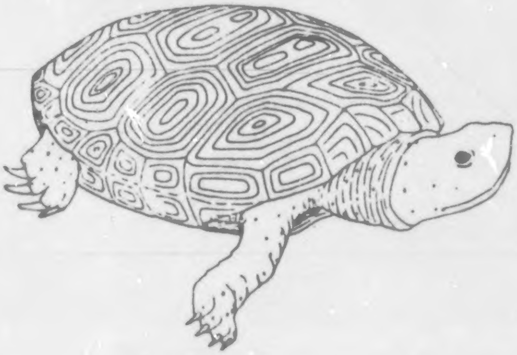
MUMMY CHOG
(Fundulus heteroclitis)

Salt Water Marsh

Not Endangered

Did you know that the mummy chog helps control mosquito populations in salt marshes? This fish swims along the tidal channels to the upper marsh and feeds on mosquito eggs and larvae.

5



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DIAMONDBACK TERRAPIN
(Malaclemys terrapin)

Salt Water Marsh

Not Endangered

Did you know that the Diamondback Terrapin has a special method for getting rid of salt? It has special glands that remove the salt from the water it lives in.

SALT-MARSH CORDGRASS
(Spartina alterniflora)

Salt Water Marsh

Not Endangered

Did you know that this plant is well adapted to the salt marsh? It has glands that excrete droplets of water. The water contains a lot of salt. In this way, the plant gets rid of a dangerous substance (salt).

SEA LAVENDER
(Limonium nashii)

Salt Water Marsh

Not Endangered

Did you know that sea lavender is one of the few wild flowers that grow in salt marshes? Why do you suppose wild flowers are so uncommon in salty areas?

GREAT BLUE HERON
(Ardea herodias)

Salt Water Marsh

Not Endangered

Did you know that the Great Blue Heron is a patient hunter? It will stand quietly for a long time. It strikes only when some tasty meal swims by.

9

10

WOODY GLASSWORT
(Salicornia bigelovii)

Salt Water Marsh

Not Endangered

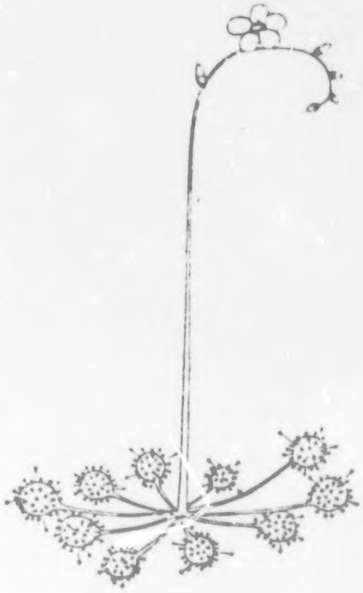
Did you know that this plant is a champion "water-holder"? Its cells store up much more water than most wetlands plants.

SALT MARSH MOSQUITO
(Aedes sollicitans)

Salt Water Marsh

Not Endangered

Did you know that this insect is a serious pest on the east coast? "Ditching" a marsh may eliminate the mosquitoes. But it usually destroys the marshes also. Is that a good exchange?



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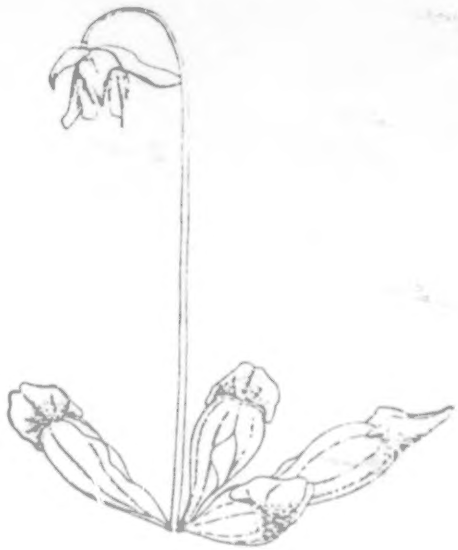

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SWAMP LOOSESTRIFE
(Decodon verticillatus)

Bog

Not Endangered

Did you know that the swamp loosestrife's roots grow out of the water? They provide the first foothold for sphagnum moss.

SUNDEW
(Drosera rotundifolia)

Bog

Rare

Did you know that sundews capture and eat insects? This is a common way for bog plants to get the nutrients they need.

PITCHER PLANT
(Sarracenia purpurea)

Bog

Rare

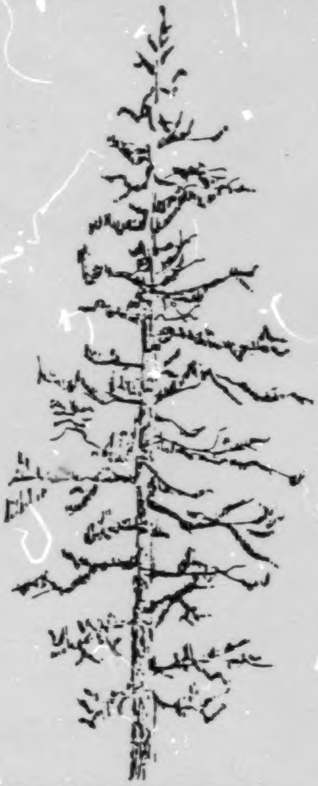
Did you know that pitcher plants have stiff hairs on their leaves? They are covered with a sweet sticky juice. Insects are attracted by this juice. When they get into the plant, they can't get back out again. Then the plant digests them.

BOG LEMMING
(Synaptomys cooperi)

Bog

Rare

Did you know that bogs are like islands? Animals can get trapped on them. They get separated from their cousins who don't live on the bog. Over time, they get more and more different from those cousins. That's what has happened to the bog lemming.



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SPHAGNUM MOSS
(Sphagnum sp.)

Bog

Not Endangered

Did you know that sphagnum moss has special cells? They help the moss to absorb lots of water . . . 100 times its own weight. That makes the sphagnum moss perfect for bog life.

AMERICAN LARCH
(Larix laricina)

Bog

Not Endangered

Did you know that the American larch drops all its needles in the fall? That's unusual for a conifer (pine-like tree). The needles collect in the bog. They make the water acidic.

CRANBERRY
(Vaccinium macrocarpon)

Bog

Not Endangered

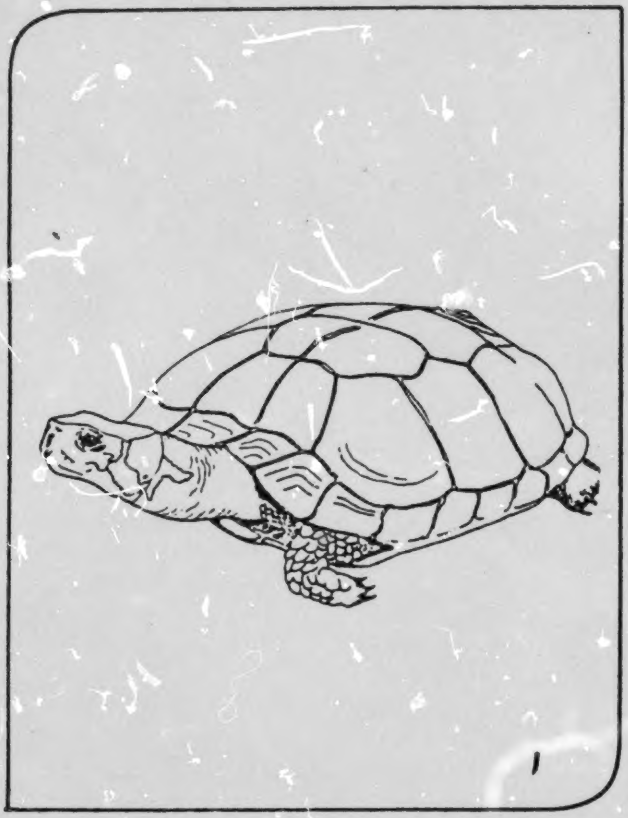
Did you know that cranberries are members of the heath family? They are the only members of the family found in bogs. They are an important commercial product.

ARETHUSA ORCHID
(Arethusa bulbosa)

Bog

Rare

Did you know that this orchid is really a tropical species? Its original home is the wet swamps of the south. There are few nutrients in these swamps. Why do you think this orchid lives in the bogs?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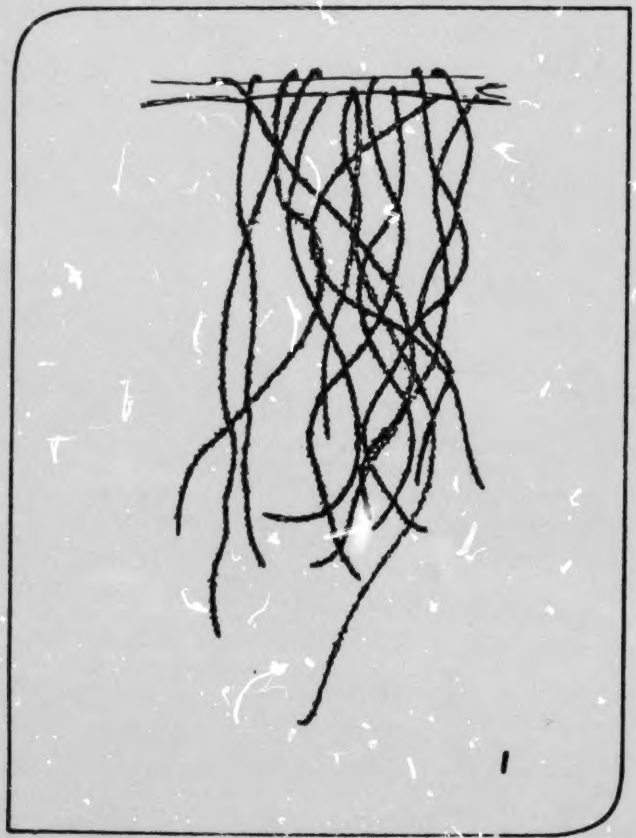
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LEATHERLEAF
(Chamaedaphne calyculata)

Bog

Not Endangered

Did you know that leatherleaf has thick leaves? They help keep moisture in the plant. This is very helpful in the bogs. It's usually very hard for bog plants to take in water.

MUHLENBERG'S BOG TURTLE
(Clemmys muhlenbergi)

Bog

Endangered

Did you know that this turtle was once popular as a pet? Many of its habitats have been drained. Now it's an endangered species.

SWAMP-LILY
(Crinum americanum)

Cypress Swamp

Not Endangered

Did you know that the swamp-lily belongs to a tropical-plant family? It's the only member of that family that lives in the United States.

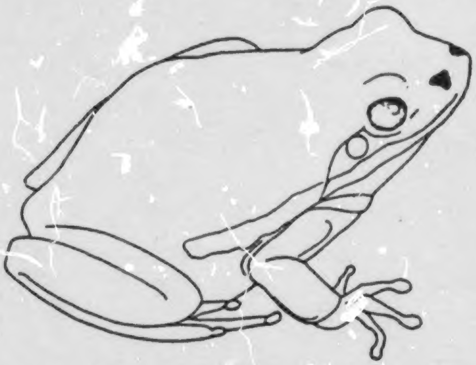
SPANISH MOSS
(Tillandsia usneiodes)

Cypress Swamp

Not Endangered

Did you know that Spanish moss grows on cypress trees? Birds and reptiles use the moss as a nest-building material.

3



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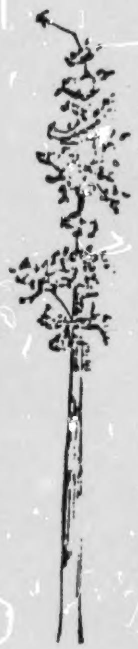

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GREEN TREE FROG
(Hyla cinerea)

Cypress Swamp

Not Endangered

Did you know that this frog is usually seen only in the spring? At mating time, it darts about and croaks in a very loud voice. The rest of the year it is very quiet and hard to find.

AMERICAN ALLIGATOR
(Alligator mississipiensis)

Cypress Swamp

Endangered in some areas

Did you know that all our alligators were almost killed off? They were killed to get their skins for shoes and purses. Now they are protected by law.

TUPELO TREE
(Nyssa aquatica)

Cypress Swamp

Not Endangered

Did you know that this tree lives only in deep swamps? The soil around it has to be flooded at least part of every year.

ARROW-ARUM
(Peltandra virginica)

Cypress Swamp

Not Endangered

Did you know that Arrow-arum seeds contain a lot of oxalic acid? That gives them an awful taste. Only wood ducks eat them regularly.

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IVORY BILLED WOODPECKER
(Campephilus principalis)

Cypress Swamp

Endangered

Did you know that the Ivory-billed woodpecker eats insect larvae? They eat only the larvae that live in dead cypress trees. The cypress trees have to have been dead for exactly three years.

SNAKEBIRD
(Anhinga anhinga leucogaster)

Cypress Swamp

Not Endangered

Did you know that the Snakebird has a neck 25 cm long? It can "fly" under water, darting this way and that to catch fish.

COTTONMOUTH WATER MOCCASIN
(Agkistrodon piscivorous)

Cypress Swamp

Not Endangered

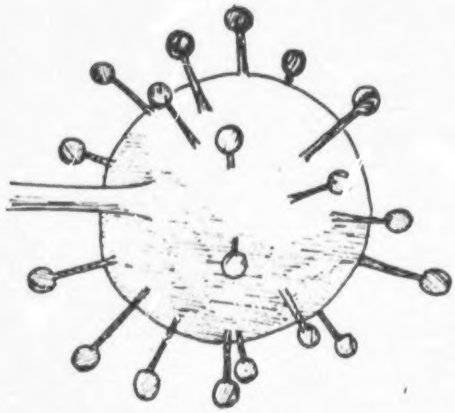
Did you know that the cottonmouth is one of the few poisonous water snakes?

BALD CYPRESS
(Taxodium distichum)

Cypress Swamp

Rare

Did you know that the cypress has a special way of getting oxygen? Most plants get it from air spaces in the soil. But cypress roots are under water. It doesn't get its oxygen in the usual way. We don't yet know how the cypress does get the needed oxygen.



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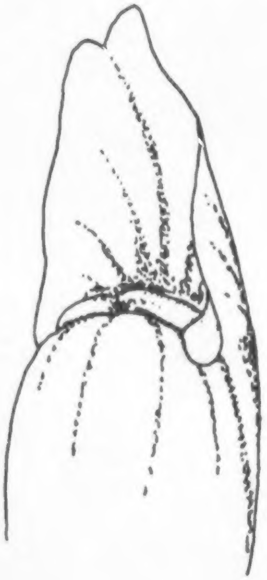

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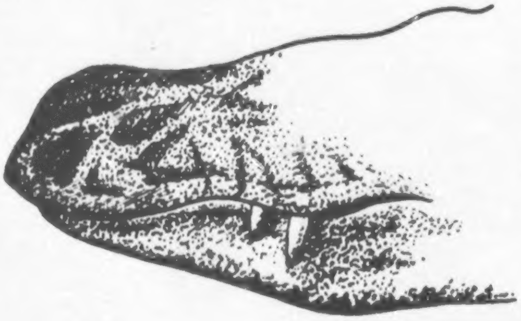
LEAF OF PITCHER PLANT

LEAF OF SUNDEW

FOOT OF BOG TURTLE

FOOT OF BOG LEMMING



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4-1308

LEAF OF ARROW-ARUM

SNOUT OF ALLIGATOR

BEAK OF IVORY-BILLED WOODPECKER

BEAK OF ANHINGA

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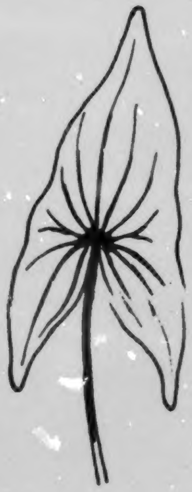

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4-14

SNOUT OF BULLHEAD

TAIL OF LONG-BILLED MARSH WREN

LEAF OF ARROWHEAD

WING OF RED-WINGED BLACKBIRD

11

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14

CLAW OF FIDDLER CRAB

ANTENNAE OF SALT MARSH MOSQUITO

BEAK OF GREAT BLUE HERON

BEAK OF OSPREY

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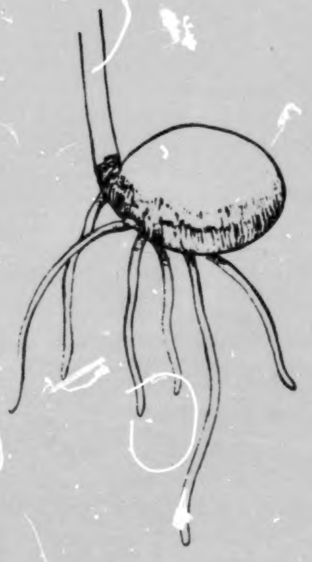

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Chapter 5
Activity Sheets

N.M. 5-1

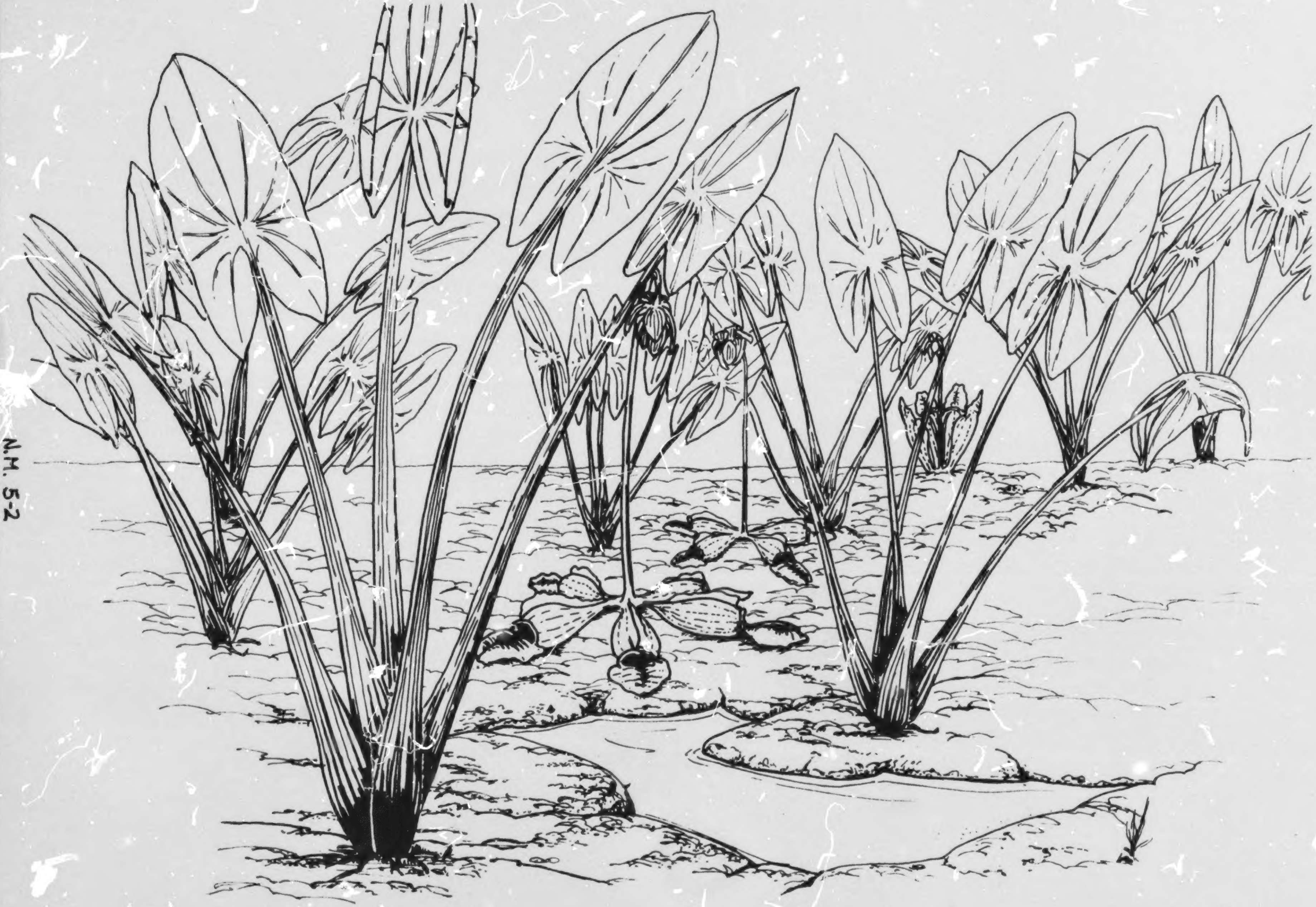
MEADOW FROG

The meadow frog can be found in marshlands in spring and winter, and in swamplands in the summer. It catches insects for food; it does this by getting close enough to seize its prey with a long, sticky tongue.

SWALLOW

The swallow is found world wide except in the polar regions where the climate is too cold for them to exist. This bird has a strong, swift, graceful flight. For food, it catches insects in mid air.

N.M. 5-2



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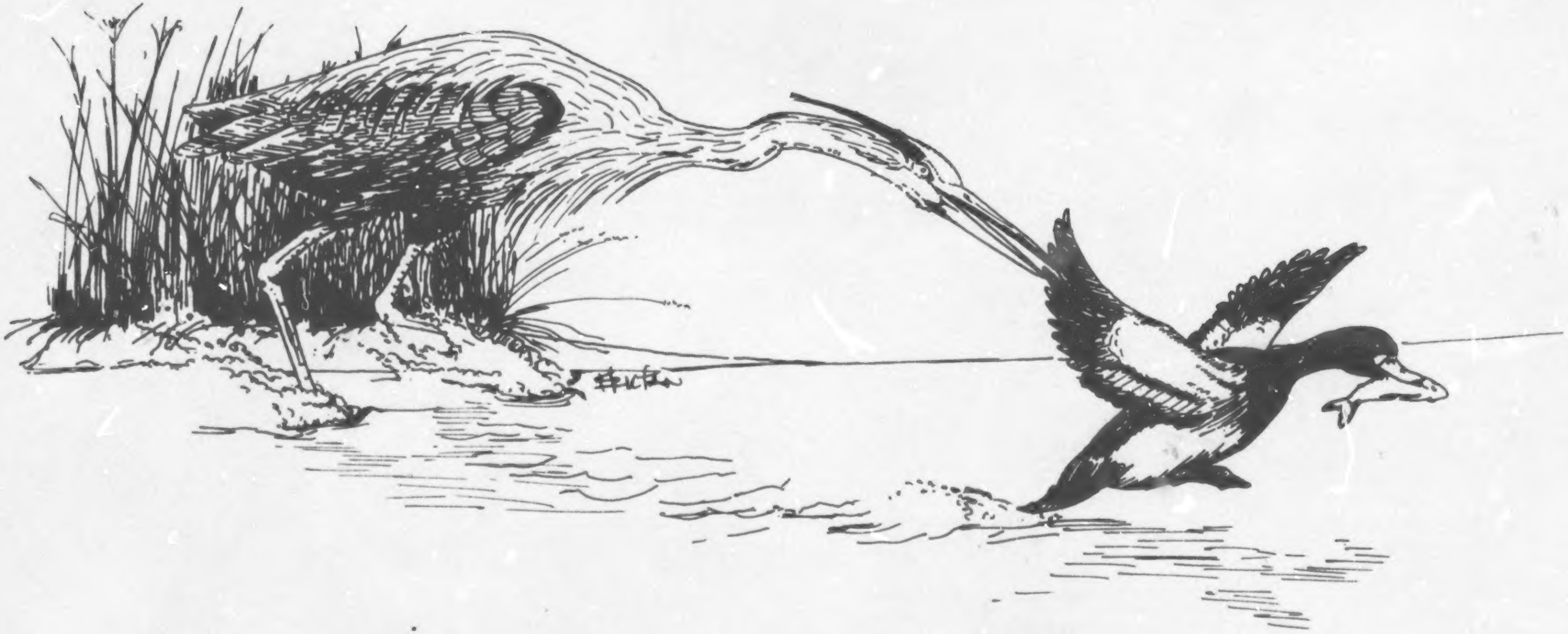
PITCHER PLANT

The pitcher plant is a bog-dwelling organism. Since bogs are normally very poor in nutrients, these plants get their necessary nitrogen nutrients when insects get trapped in the hollow cavity of the leaves. Slippery hairs inside the "pitcher" prevent the victims from escaping. The insects are digested by juices inside the cavity.

ARROWHEAD

The Arrowhead is found in the moist, nutrient rich soils of freshwater marshes, ponds, and stream banks. It absorbs its nitrogen nutrients through its roots.

N.H. 5-3



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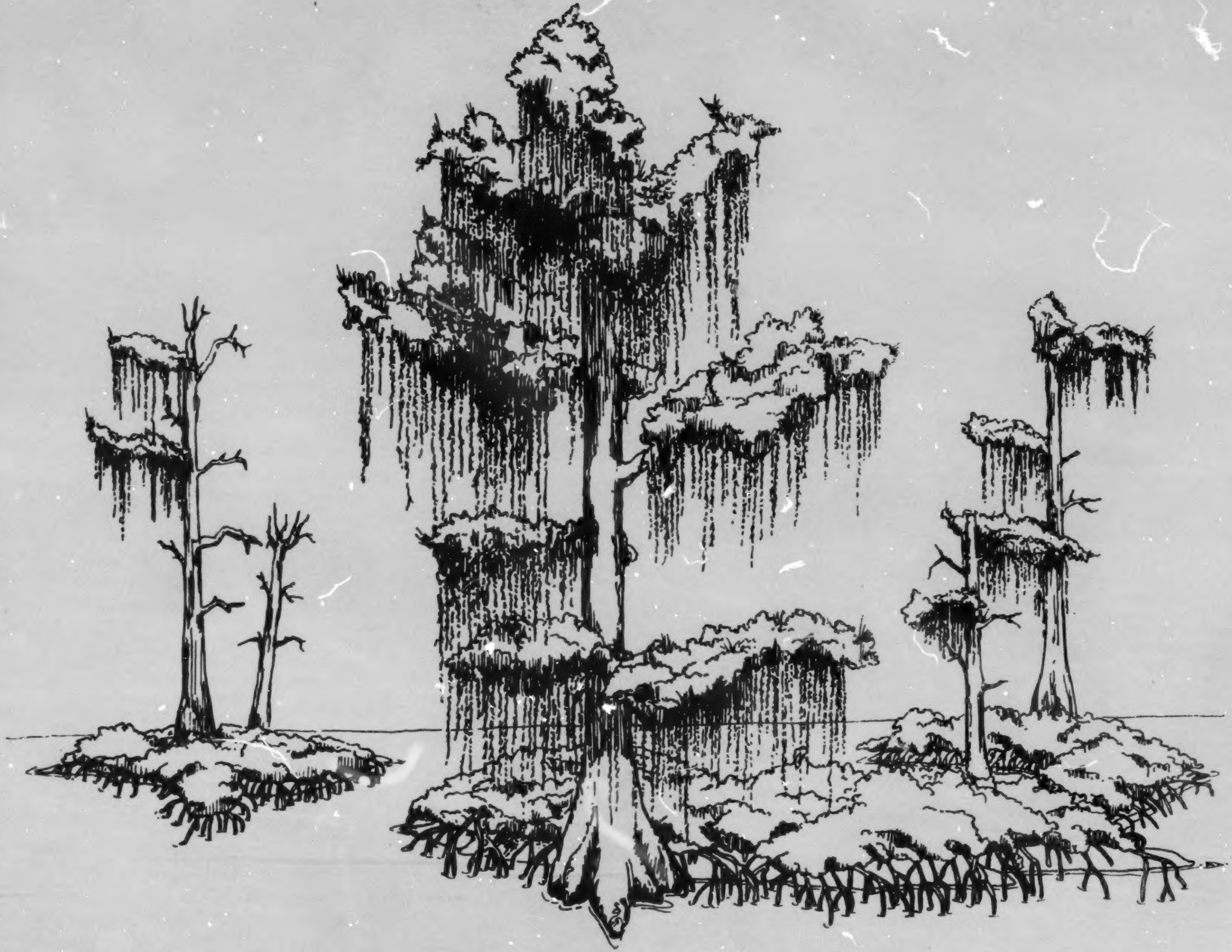
GREAT BLUE HERON

The Great Blue Heron lives in salt marshes and freshwater marshes, across the United States. Its main food is fish but the Heron also eats frogs, crabs, shrimp, worms, and snails.

MALLARD DUCK

Mallard ducks inhabit freshwater marshes, lakes, ponds, and estuaries. Food for these ducks consist of leaves, seeds, grains, berries, insects, and tiny fish.

N.M. 5-4



1'24

1'25

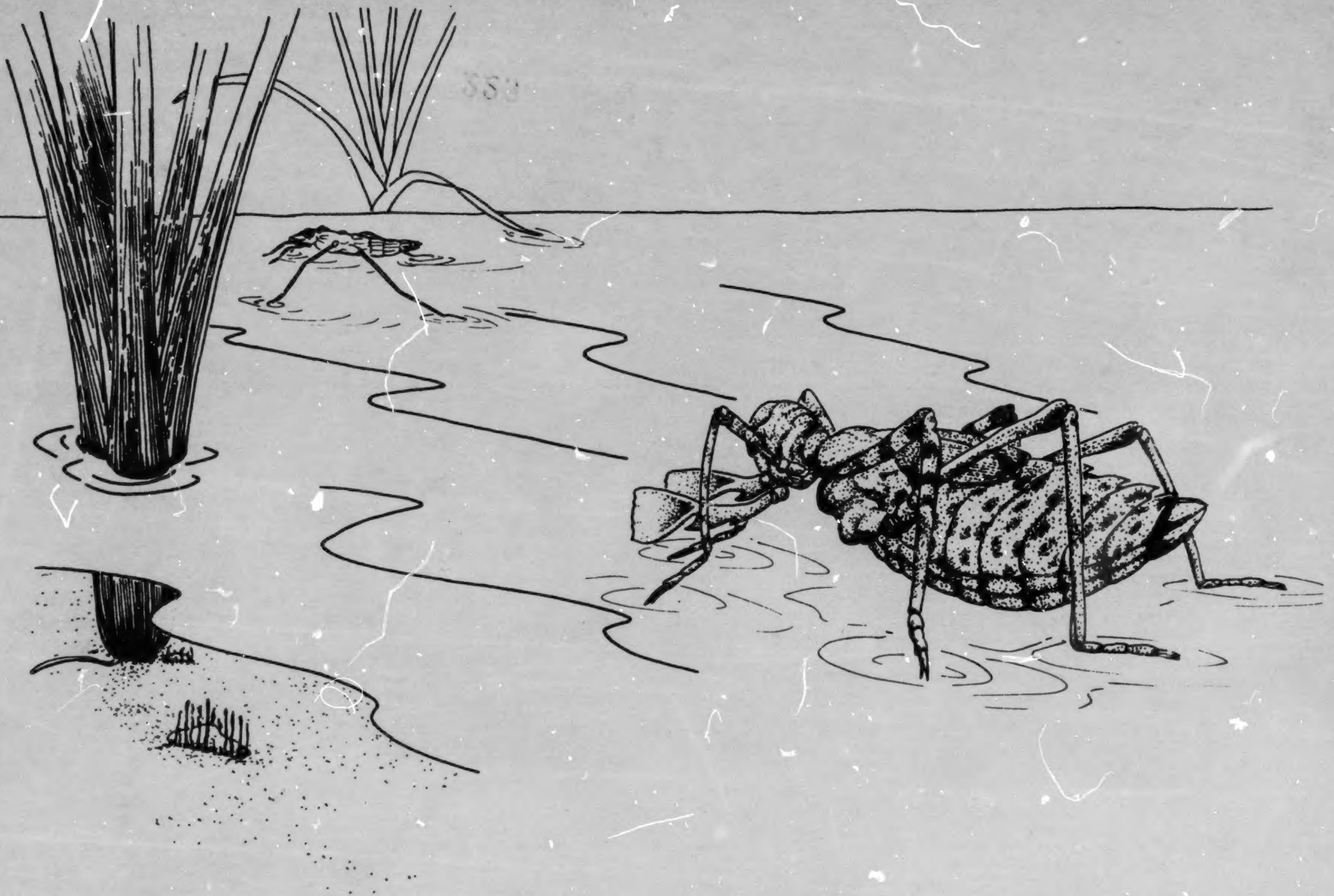
BALD CYPRESS

Bald Cypress trees grow in freshwater swamps and other areas where the soil is saturated or seasonally submerged in freshwater. Bald cypress can not tolerate salt water or salty soil.

MANGROVE

Mangroves are large woody plants with a mangle of roots forming a dome beneath them. Mangroves are found in the southeastern United States. They grow in coastal soils that are saturated with salt water. Clusters of mangroves can often be seen growing on little mud islands in saltwater swamp areas.

N.M. 5-5



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WATERSTRIDER

Waterstriders may be found on the surface of any body of freshwater. They fed on other insects which are at the surface of the water.

DRAGONFLY NAIADE

The young stage in a dragonfly's life cycle--the naiade--lives in the sediments beneath the water's surface in marshes, lakes, and ponds. It is an aggressive predator, feeding on other insects, tadpoles, and even tiny fish.

N.H. 5-6

BOG TURTLE

The bog turtle inhabits sphagnum bogs. It feeds both on land and underwater, eating insects and berries. The bog turtle has many enemies, including dogs, foxes, skunks, and racoons. This little turtle is endangered because humans have drained bog lands destroying its home.

ALLIGATOR

The alligator in America is restricted to the warm swamplands of the southeastern states. It feeds on frogs, snakes, fish, and small mammals.

N.M.5-7
133
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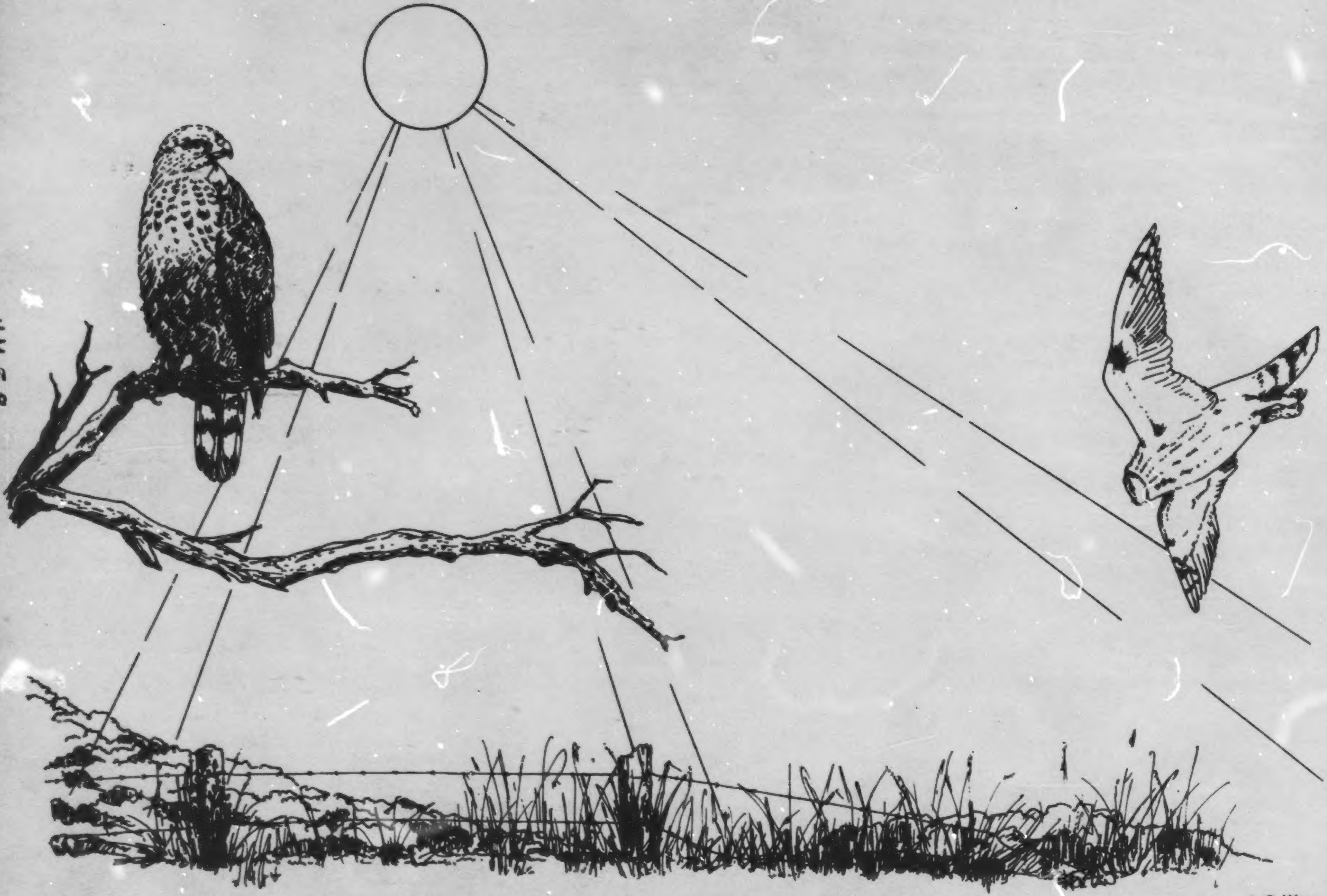
AMERICAN BEAVER

The American beaver is found in wooded lands throughout the United States, Beavers use mud, stones, and tree logs to build the dams which are homes for them. Food for the American beaver consists of roots, twigs, leaves, and bark.

MUSKRAT

The muskrat inhabits salt marshes, freshwater marshes, and areas around lakes and rivers. Muskrats construct dome-shaped houses, on the water, out of reeds and other grassy plant material. They eat mostly water plants, but occasionally fish or mussels.

N.M.5-8



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MARSH HAWK

The Marsh Hawk inhabits marshlands. It has a fast, silent, low-level flight which allows it to take its prey by surprise. It feeds on frogs, bird eggs, insects, rabbits, and mice in broad daylight. The marsh hawk rests during nighttime.

BARN OWL

The barn owl is found widespread throughout most of the world. It lives in open country from desert lands to marshlands. The owl's wide, long wings have a fringe of soft feathers which creates a smooth, quiet airflow. This is the secret of its silent flight. The barn owl's very good night-vision allows it to feed on frogs, bird eggs, rabbits, and mice in the dark of night. The barn owl rests during daylight hours.

Activity Packet 5

Create an Organism

SHELTER
Organism rests head down on limbs of trees 10 meters from open water. It must cross hot gravel in summer and ice in winter to get food.

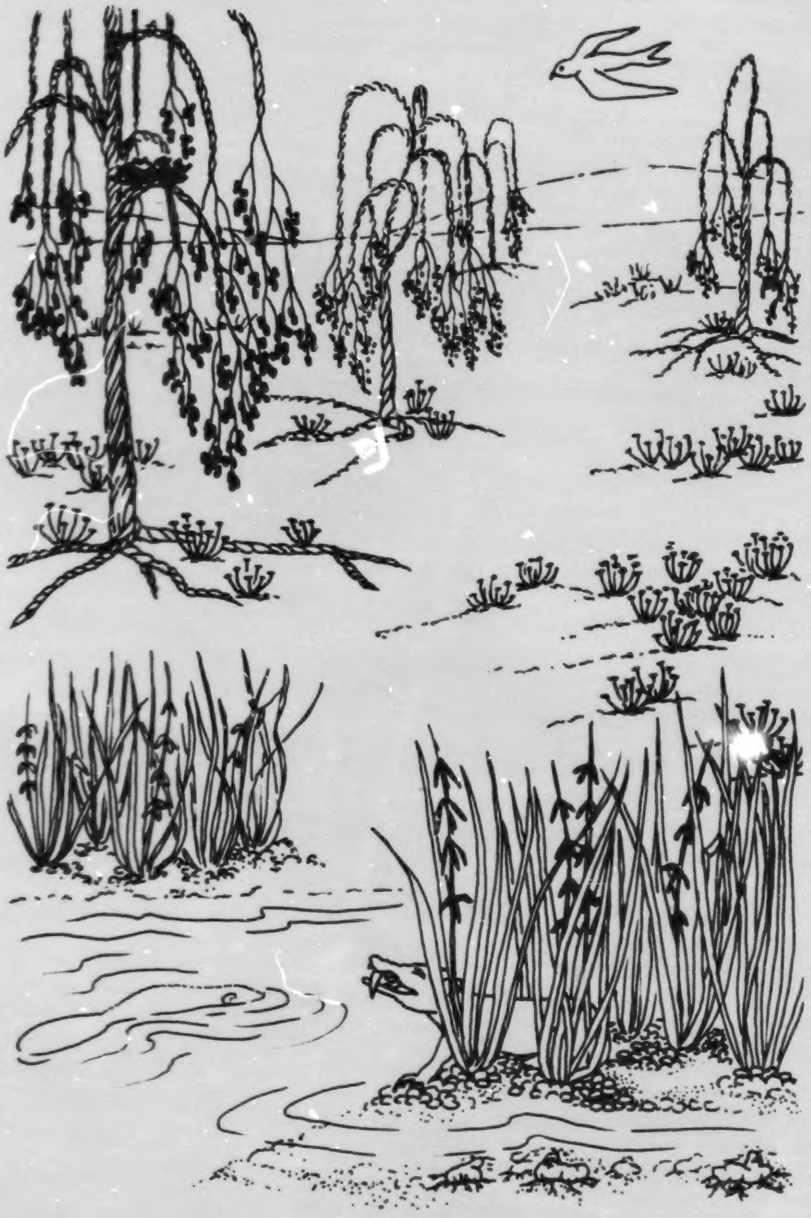
COMPETITORS
Competes with beaverlike organism for food. Competes with hawklike bird for shelter.

TEMPERATURE
Summer temperatures get as high as 55°C. Winter temperatures often get as low as -30°C.

PRECIPITATION
There are heavy rains during spring and fall and heavy snows during winter. Summers are very dry.

ENEMY
The organism is eaten by the sabre tooth mongoose.

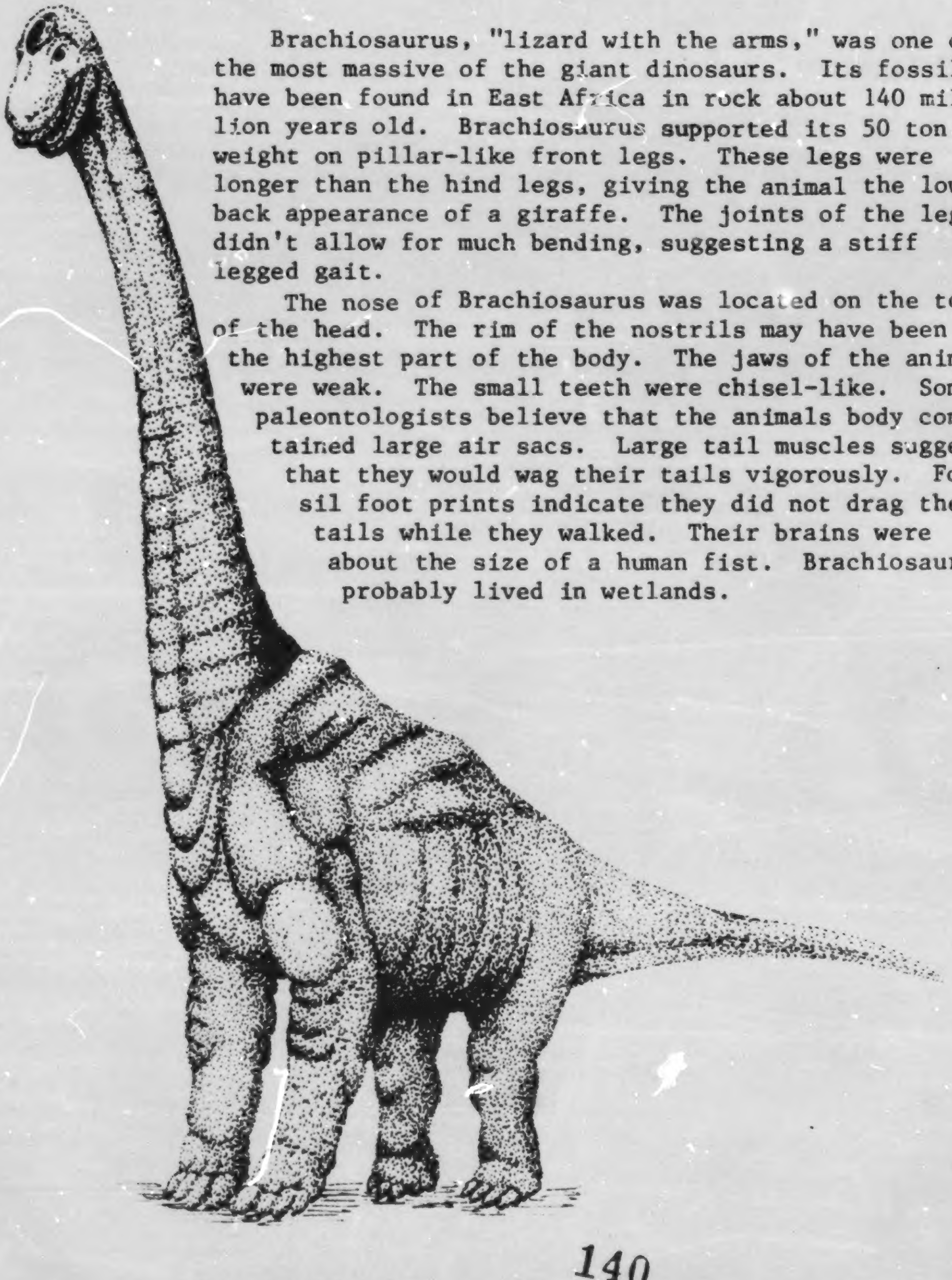
FOOD
Eats roots of an emergent water plant. Organism must dig beneath water and dig root from one meter of mud. Covering of root is as hard as Brazilnut.



C.A.O. 5-9

Activity Packet 5

Brachiosaurus



Brachiosaurus, "lizard with the arms," was one of the most massive of the giant dinosaurs. Its fossils have been found in East Africa in rock about 140 million years old. Brachiosaurus supported its 50 ton weight on pillar-like front legs. These legs were longer than the hind legs, giving the animal the low back appearance of a giraffe. The joints of the legs didn't allow for much bending, suggesting a stiff legged gait.

The nose of Brachiosaurus was located on the top of the head. The rim of the nostrils may have been the highest part of the body. The jaws of the animal were weak. The small teeth were chisel-like. Some paleontologists believe that the animals body contained large air sacs. Large tail muscles suggest that they would wag their tails vigorously. Fossil foot prints indicate they did not drag their tails while they walked. Their brains were about the size of a human fist. Brachiosaurus probably lived in wetlands.

C.A.N. 5-10

No Activity Sheets For This Chapter

Soaking up Water

Chapter 7
Activity Sheets

Activity Packet 7

Data Sheet

	Amount of Water that Runs through Soil Tester after		
	1 minute	2 minutes	3 minutes
Sod			
Sand			
Clay			
Moss			

Activity Packet 7

Data Sheet 2

a. There was no flooding in drawing #1 because ______

b. There was flooding in drawing #2 because ________

c. In drawing #3, there would/would not (choose one) be flooding in Holsum City because

d. In drawing #3, there would/would not (choose one) be flooding in Jestertown because

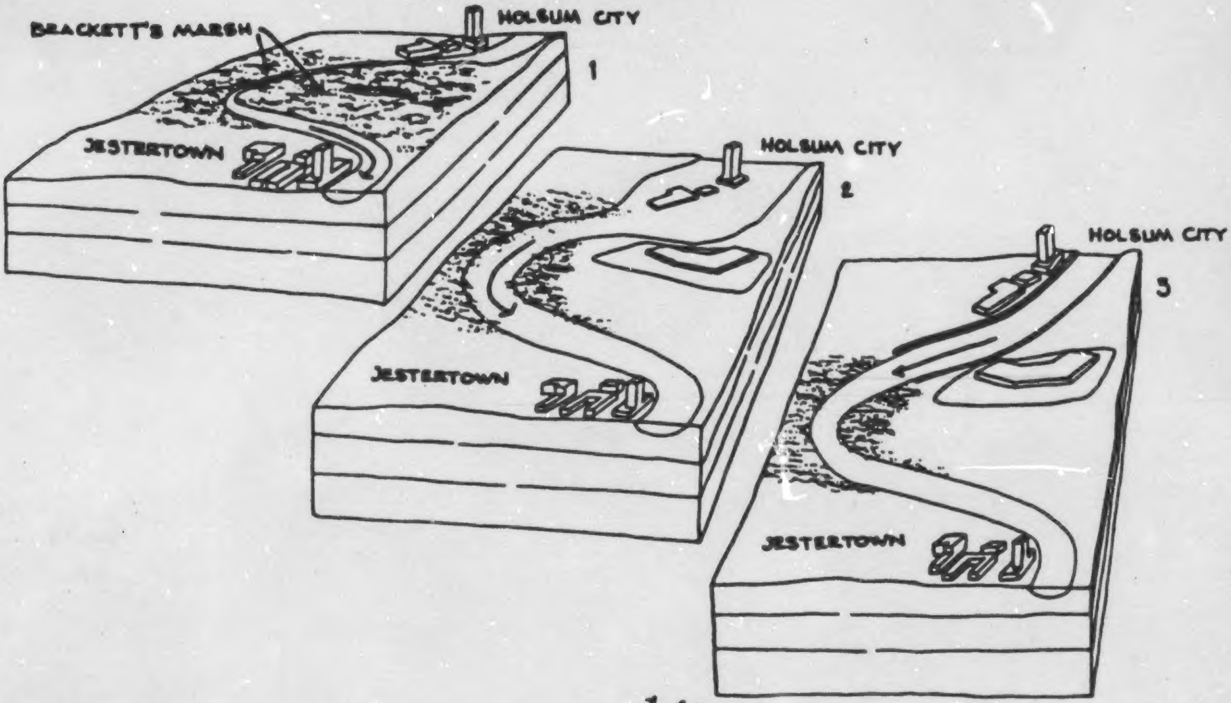
Activity Sheet 7-1

Floods on the Snake River

The three diagrams below show a section of the Snake River and the area around it. Each spring rains cause the Snake River to become very full. At one time (drawing #1) floods were rare in Holsum City, no matter how much rain there was. Why do you think that was? Write your answer in the space provided on Data Sheet 2.

A few years ago, a large shopping center was built across the river from Holsum City. Brackett's Marsh was filled and covered with asphalt to build this shopping center. The next few years, Holsum City was flooded every year. Why do you think that was?

Recently large cement dikes were built on both sides of the Snake River at Holsum City. What effect do you think this will have on flooding in Holsum City? What effect do you think this will have on flooding in Jestertown? Explain how you got your answer in each case.

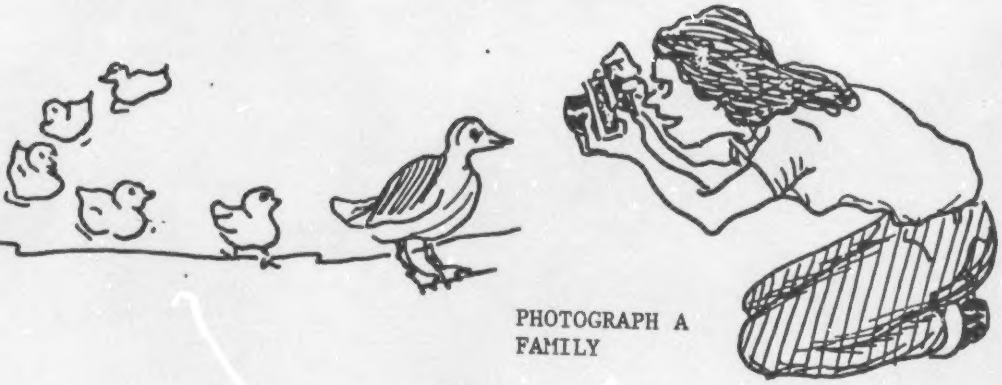


Chapter 8
Activity Sheets

Activity 8

Arts Festival

PAINT A PICTURE



PHOTOGRAPH A FAMILY

TOSS A SALAD

WRITE A POEM

CREATE A WETLANDS MELODY ON A GUITAR

CLARK JR. HIGH
WETLANDS ART FESTIVAL
CLARK JR. HIGH'S
Wetlands
art festival
April 2, 3, 4, + 5
Room 214

No Activity Sheets For This Chapter

Chapter 10
Activity Sheets

Activity Packet 10

Field Trip Guidelines

Take this sheet with you on your field trip. If you do not go on the trip, use it when your expert talks to the class. Write down your answers on this sheet.*

1. What are some good things about the wetlands just the way you see it now ?

2. In what ways has the wetland been changed already? Can you find evidence that people have been here?

3. What are some of the ways that this wetland could be changed in the future?

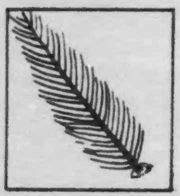
4. What things would be different about the wetlands in five years if it was changed?

*You should think very carefully about taking anything out of the wetland. If you have been told to collect a plant or an animal, it will probably be all right for you to do so. But it usually is not a good idea to remove just anything that you would like to carry home with you. Many times, a photography, a sketch, or tape recording is as good as having the live specimen itself. Check with your teacher to see what you should and should not collect in the wetland you visit.

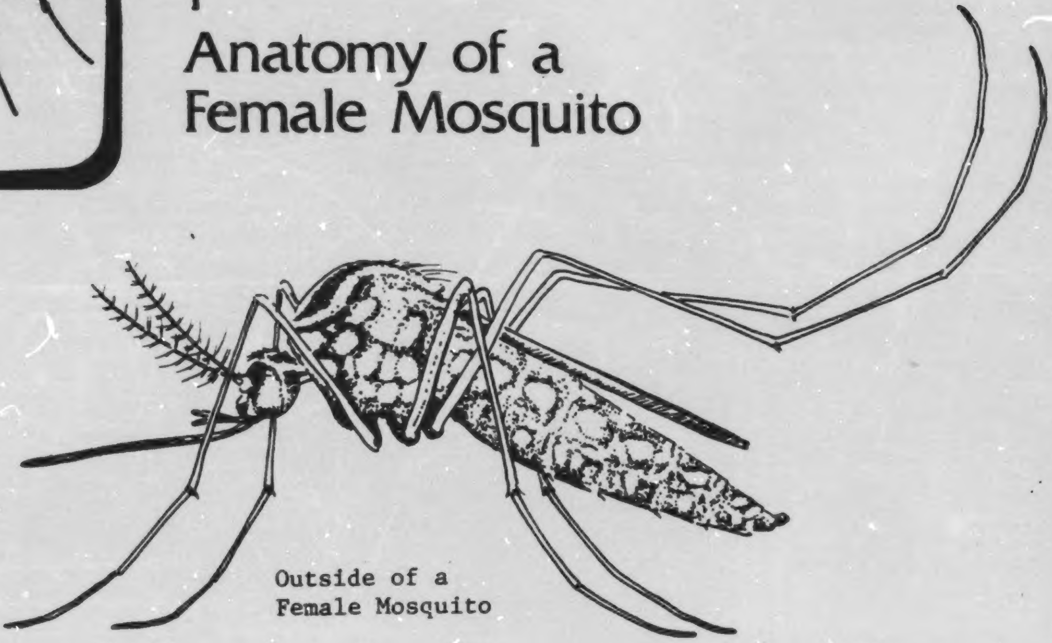
Chapter 11
Activity Sheets

Activity Packet 11

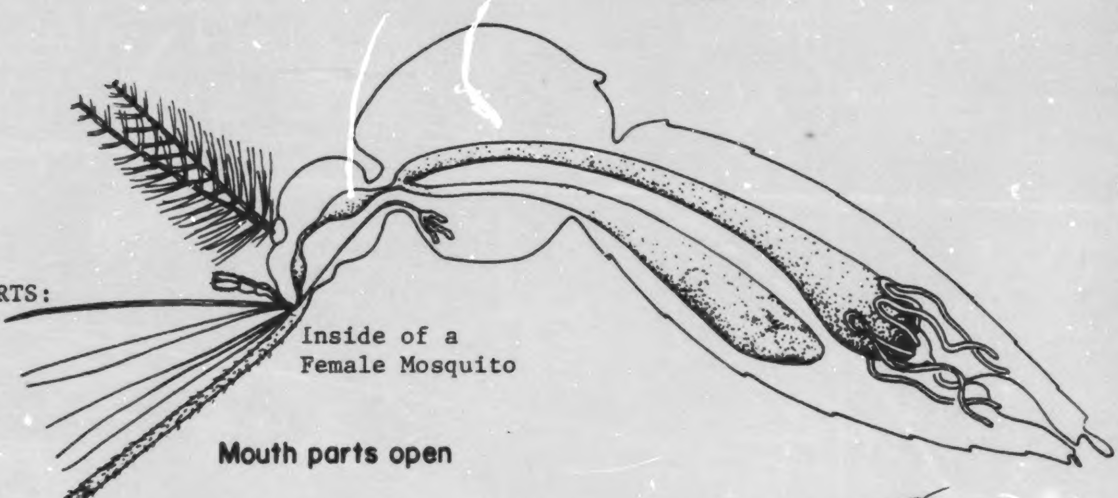
1
Anatomy of a Female Mosquito



Male Antennae



Outside of a
Female Mosquito

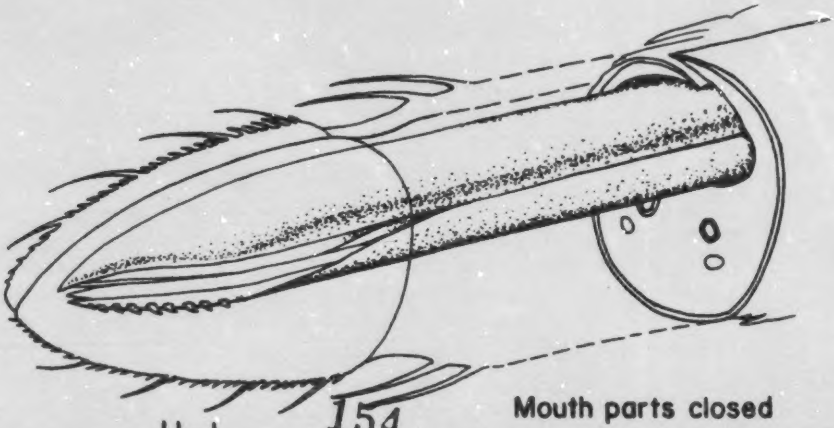


Inside of a
Female Mosquito

Mouth parts open

LABEL THE PARTS:

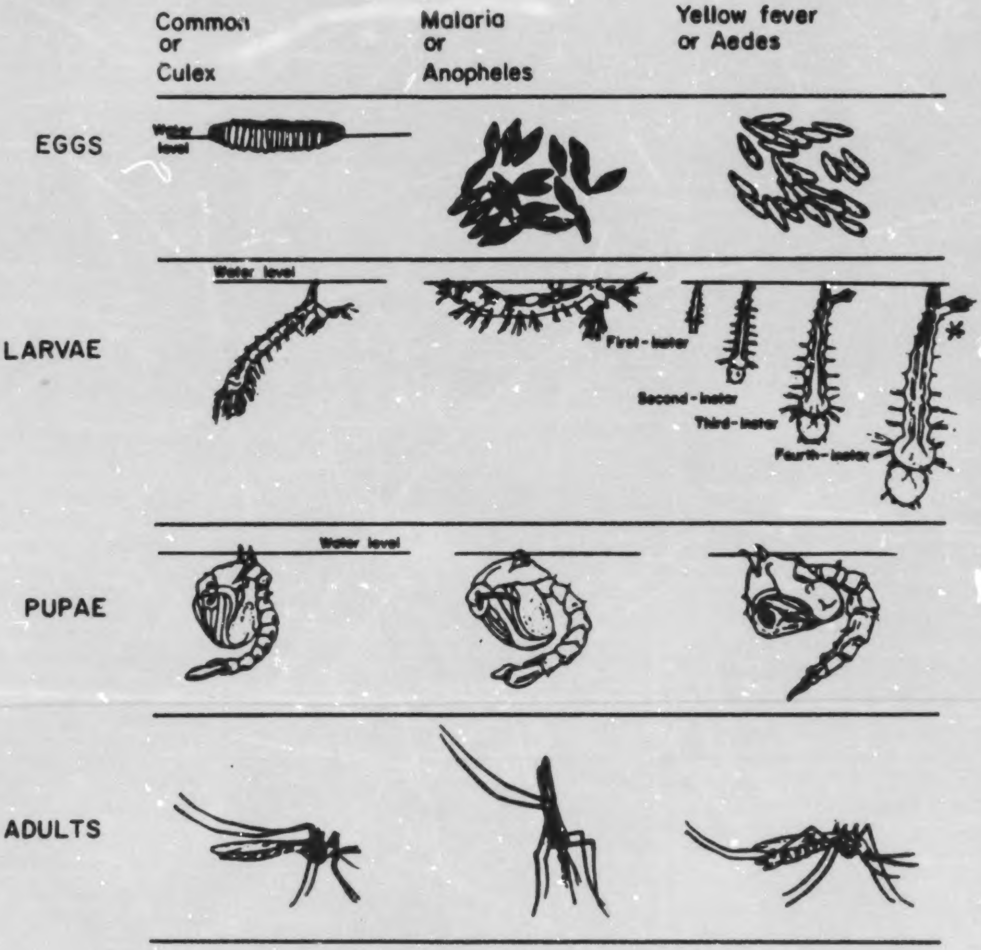
Antenna
Head
Eye
Thorax
Abdomen
Wing
Mouth Parts
Maxillary Palps
Mouth
Pumps
Pharynx
Stylus
Hind Gut
Rectum
Blood Storage Sac (crop)
Salivary Gland
Sheath of Mouth Parts



Mouth parts closed

Activity Packet 11

2
Mosquito Development



1. How do the eggs of the common, malarial, and yellow fever mosquitoes differ?
2. How do the larvae of the three kinds of mosquitoes differ?
3. How do the pupae of the three kinds of mosquitoes differ?
4. How do the adult females of the three kinds of mosquitoes differ?

*All larvae go through four instars

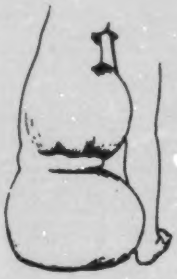
Activity Packet 11

3
Diseases

Not too many years ago, one person died each ten seconds of malaria.

Why is malaria no longer the very serious disease it used to be?

Elephantiasis, filariasis or moomoo, a disease that causes parts of the body to swell, is carried by mosquitoes. What kind of an organism does the mosquito inject into the body? How does the disease organism cause swelling?



Yellow fever is a virus disease carried by one species of mosquito.

Give an example of how this mosquito and yellow fever have changed the course of human history.

The only serious mosquito disease in America is encephalitis.

What is being done to prevent the spread of this disease?

Ordinary mosquito bites result in the loss of blood and an itching welt. What is that welt? Why does it itch?

Activity Packet 11

4

How good are the modern methods of getting rid of mosquitoes?

List one advantage and one disadvantage of each of the following methods of insect control.

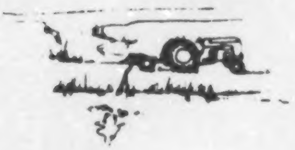
1. Repellents

2. Chemical Insecticides

3. Mosquito screen and nets

4. Oil and detergents on breeding waters

5. Predators



6. Draining breeding grounds

Activity Packet 11

5
Difficult Decisions

Suppose you lived in an area known for its wetlands and mosquitoes. You love the marshes around your home for their beauty and richness of plant and animal life. You know that the marshes are important breeding grounds for organisms. They are also important reservoirs for water after heavy storms. But mosquitoes are so annoying you can't stand to be outdoors half the time you are home. Some years the mosquitoes are so bad they change the moods of people. Many of your neighbors are so upset about these insects they will leave if something isn't done about them soon.

Action is urgent. Here are some choices. Pick one.

1. Leave the area.
2. Drain the marshes to prevent the mosquitoes from breeding.
3. Increase taxes to buy and spray insecticides.
4. Use insect repellents and hang in, hoping research scientists will develop effective controls.
5. --------------------------

Defend the decision you made. ____________________

____

____

11-5

There are few corners
of the earth where this pesky
nuisance doesn't penetrate
—and proliferate

The Malevolent Mosquito

Condensed from TODAY/THE PHILADELPHIA INQUIRER
RICHARD CONNIFF

FEW PEOPLE have lived at any time without knowing the mosquito, suffering its bite and its awful, random power, be they in London, Kuala Lumpur or Philadelphia. The bite is a fascinating act, as the frail, quarter-inch, translucent creature flies into your bedroom, inserts its pointy snout and draws your fresh blood up into its belly.

Only the female mosquito will bite you—she does so because she needs blood to reproduce—but she will not do so every time she gets the chance. Some of the 2700 mosquito species bite only in daylight, others only at dusk or when it is dark. Her body, with its spiny array of wings, legs and antennae poking out in all directions, seems an unlikely aircraft. In fact, though, the mosquito shows remarkable agility in flight. She can hover, loop-the-loop, speed up suddenly or slow down, dart between slapping hands, even fly upside down, sideways or backward. According to English insect specialist J. D. Gillett, some mosquitoes can fly through rain, dodging drops, and arrive dry at their destination.

As she searches for you, her wings beat from 250 to 600 strokes a second (depending on her species and, to a lesser extent, her speed). She achieves this rapid wingbeat not by continuous conscious exertion, but by "switching on" the unusual wing muscles in her midsection. Until she switches them off again, these muscles automatically contract and relax at incredible speed.

Because the night-biting mosquito cannot see in the dark, she must

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11-6

This Culex mosquito has just inserted her pointy snout (the proboscis) into a human being and is filling up with blood

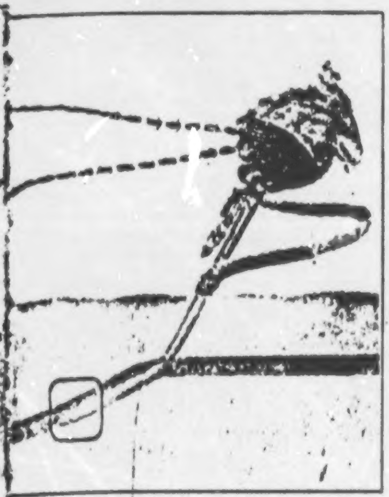
use sensors on her two antennae and three pairs of legs to find you. As Wayne J. Crans, who teaches mosquito biology at Rutgers University in New Jersey, describes it, she catches your scent by the stream of exhaled carbon dioxide "downwind" from where you are sleeping, then zigzags toward its source: your unwary self. Now, within a few inches of you, her infernal buzzing may even rattle you from your sleep.

This unsettling alarm is caused by the mosquito's rapid wingbeat and the vibrating muscles of her midsection. As she circles noisily above you, close-range sensors—attuned to moisture, warmth and substances in sweat—determine whether you are a suitable victim. On close inspection, she may find you unappealing, or may simply prefer your spouse. It depends on her reaction to your body chemistry.

Assuming the mosquito finds you delectable, she settles ever so gently on your flesh. You will probably not notice, for mosquitoes are extraordinarily light-footed. (One species can land on a spider's web without alerting the spider.) Nor are you likely to notice as she deftly pierces your skin with her proboscis tip.

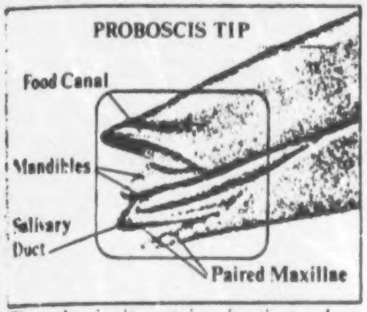
This snout, jutting from just below the mosquito's eyes, is not one, but six sharp instruments (stylets), all finer than hairs: two tubes (food canal and salivary duct) encircled by two lancets (called mandibles) and two serrated knives (paired maxillae). A gutter-shaped sheath wraps protectively around these stylets along their entire length. Finally, a clamp attached to the sheath at the tip of the snout cinches the six stylets together in a single bundle. With this formidable weapon, the mosquito goes to work.

PHOTO: C. BRUUN [illegible]



uito's proboscis buried in a human capillary. ea enclosed in the square is enlarged below

She drives all six stylets into your skin at once. They penetrate about the length of a second-day whisker, entering your closely knit web of capillaries. If the mosquito succeeds in penetrating one of these thinner-than-hair blood vessels, she has tapped a gusher and will require only a minute to take a full meal from its steady flow. All this normally passes unsuspected by the victim.



The proboscis tip contains six minute, sharp instruments which the mosquito uses to penetrate our skin and suck blood

Just before the mosquito begins pumping up your blood, she dribbles saliva down the smaller of the two stylet tubes. Beneath your skin, this mixes with the blood and prevents it from clotting midway up the mosquito's snout. With the help of this anticoagulant, she can pump enough blood up the larger stylet tube to turn her long abdomen into a swollen, red paunch. (This sounds bad, but 15 or 20 such meals equal only a single drop from an eyedropper.) Unfortunately, a residue of saliva remains beneath the skin after each bite to vex you with an itching welt. By then, more often than not, the mosquito has lumbered off, like an overloaded cargo plane, leaving you to slap and scratch in vain.

The mosquito now seeks only rest. Weighed down with your blood, she settles on a wall or a leaf outside to wait. During the quiet days that follow, she will use that droplet of blood to produce hundreds of eggs.

Even before the mosquito has taken her first blood meal, she has mated, attracting a male by the distinctive buzz of her wingbeat. That single mating suffices for the four or five times she will lay eggs during the month or two that she lives. Each time, as she prepares to lay her eggs, she fertilizes them herself with the male seed stored within her.

All mosquitoes pass through their immature stages—egg, larva and pupa—in or around water. Indeed, all mosquito eggs need water to

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hatch, but some will hatch just a few days after they are laid, others only after freezing through a winter, still others only after drying out. In fact, some eggs laid by the millions at floodwater levels may survive five years on dry land until floodwaters come again to hatch them. This is why heavy rains produce such large crops of mosquitoes.

Once the female has emerged from the larval and pupal stages, she will not necessarily search out a human victim. Some species may prefer elephants, some mice. One New Jersey mosquito even bites turtles through the shell. Another species, in Africa, preys only on a hardworking ant, drawing from its mouth not blood, but honey. Other species—and all males—survive solely on the nectar of flowers and may play an important role in pollination.

Still, plenty of mosquitoes bite people. In ancient Greece, the mosquitoes were so malevolent as to empty rich and beautiful cities. Among weak-hearted Pilgrims, local "muskeetos" were good reason to flee the settlement. Alaskan mosquitoes have driven explorers to the verge of insanity and suicide. At the height of the 1858 summer season in Atlantic City, tourists maddened by the constant biting of the "Jersey terror" fought their way onto homebound trains, and even bribed conductors to let them aboard.

Through the ages the mosquito has been not only a nuisance but a killer, carrying some of the deadliest diseases known to man. According to the National Center for Disease Control, malaria has probably had "a more profound influence on world development" than any other disease. It brought down the ancient civilization of Ceylon and may have contributed to the decline of Greece and Rome.

Yellow fever, too, has had an enormous impact on history. In 1793 it sent 12,000 of Philadelphia's 55,000 residents, including President Washington, into flight. In just two months, it infected 17,000 people and killed 5000. In 1802, France dispatched 33,000 men to conquer Haiti and, from there, to secure its control of the Mississippi Valley. Mosquitoes stopped the force with a devastating epidemic of yellow fever. This led directly to the Louisiana Purchase, in which the United States bought—at a fraction of its worth—the entire territory from the Mississippi to the Rocky Mountains.

The devastation of mosquito-borne diseases continues today. Although now limited to Africa and South America, yellow fever is still deadly. Filariasis and dengue, while seldom fatal, remain serious problems, too, throughout the tropics. Largely through the work of the World Health Organization, most developed countries have eradicated malaria or brought it under control. (This country completed eradication on its own just after World War II.) Nevertheless, the disease afflicts more than 150 million people each year, killing one million children in Africa alone. It usually does not kill its adult victims outright. Instead it gradually weakens them, and they become prey to other diseases.

Encephalitis, the only mosquito-borne human disease now active in this country, can kill its victims or cause them permanent brain damage. Common birds, from cardinals to meadowlarks, make up the main "reservoir" of the disease. The mosquito spreads the disease from bird to bird and can also pass it from bird to human. Most years there is little risk of humans contracting encephalitis, but when mosquitoes are abundant (after heavy rains, for instance) the risk increases.

Donald Sutherland, insect physiologist at Rutgers, says you can best protect yourself from both nuisance and disease by using mosquito repellent. Applied to the skin, this will confuse the mosquito's sensors—just as she is about to land—and will prevent her from biting. (At least you hope so.) Light-colored clothing may also deter some species, and a good set of house screens provides protection.

More important, you can eliminate mosquito-breeding places from around and even within your own home. Remember: The smallest accumulation of water—in a beer can, a flower vase, a paint bucket, an old tire—can produce hundreds of mosquitoes in just one week. If a problem goes beyond your ability to reduce it, call your local mosquito-control agency for help.

No matter what you do, no matter how wildly you swat about, a mosquito is going to get you soon. When it does, daub a little rubbing alcohol on the welt. Then sit back and wait, more warily now, for what D. H. Lawrence called that "small, high, hateful bugle" in your ear.

Papa Bare

ABOUT TWO O'CLOCK ONE SUMMER MORNING, my friend and her husband, who likes to sleep in his birthday suit, were awakened by a thunderstorm. They both dashed from the bed and began shutting windows. When her husband got downstairs, he realized the umbrella on the patio table had been left open and gusts of wind were causing the table to teeter precariously near the glass doors. He figured it would take only a moment to run out and take the umbrella down, so he did not waste time fetching a robe. Once on the patio, however, he found the wind was stronger than he expected. Before he could close the umbrella, the wind lifted the shaft from the table and pulled it and him out into the yard. As he grappled with the umbrella, several flashes of lightning lit up the yard like a Broadway stage. Finally, he accomplished his mission and went back into the house, much to the relief of his wife, who had witnessed the entire episode.

They had no sooner settled in bed than the phone rang. It was their neighbor, who said, "We just wanted to let Mary Poppins know how much we enjoyed the show."

—Contributed by Dorothy Bruni

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No Activity Sheets For This Chapter

Chapter 12
Activity Sheets

Activity Packet 12

Suggested Questionnaire

1. What do you think the word wetlands means?

2. Can you name any wetlands in our area?

If the person you are interviewing cannot answer questions 1 and 2, then read the description in the box below. If the person can answer questions 1 and 2, proceed with question 3.

> "Wetlands are areas that are under water part or all of each year. Swamps, marshes, and bogs are wetlands. In our area an example of wetlands is (name a wetland in your area). Many wetlands areas are threatened today. People want to fill them in or drain them to use for other purposes. In our area, (tell how the wetland is threatened).

3. Do you think that (wetland mentioned above) should be changed or left the way it is? ____________________

4. Why?

Activity Packet 12

Data Sheet for Suggested Questionnaire

Person	Male/ Female	Over 30/ Under 20	Q1*	Q2*	Q3*	Q4*

Q1: Know wetlands? Yes or No
Q2: Name wetlands? Yes or No
Q3: Save wetlands? Yes or No
Q4: Why? Write answer given by person

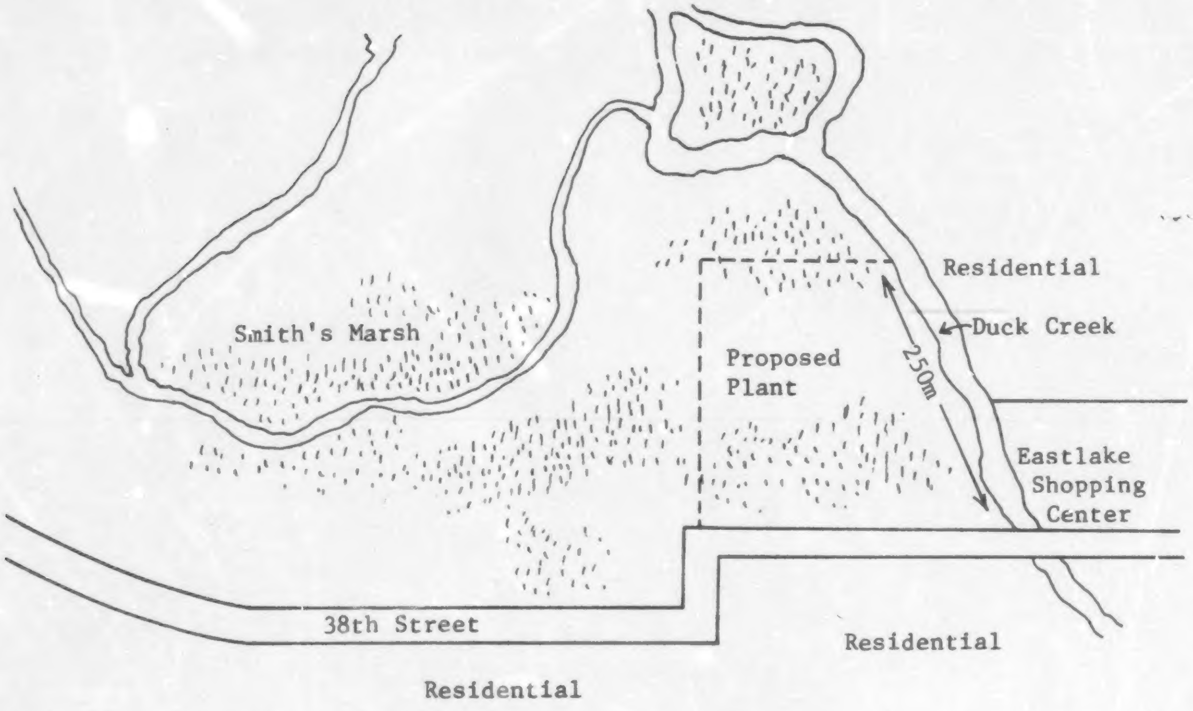
Activity Packet 12

INTRODUCTION

Here is an imaginary case study. You can use it if you do not have an endangered wetland in your community. Have each person read the case study before you ask them any questions.

CASE STUDY

This map shows the location of Smith's Marsh. It lies at the edge of Jamesville, a city of 22,000 people. There are no roads, and only a few footpaths through the marsh. At least 70% of the ground in Smith's Marsh is covered with water to a height of 20 cm all year round. Plants and animals found here are typical of freshwater marshes elsewhere and include cattails, arrowheads, sedges, sandhill cranes, pike, and sunfish. Except for an Indian camp along Duck Creek more than 100 years ago, humans have not lived on or used the marsh.



A proposal has recently been received by the City Planning Commission for construction of an industrial area in one corner of the marsh. The building, roads, and parking lots will cover 12.5 acres, about 1/8 the total area of Smith's Marsh. The proposed site will be the new home of the Do-Rite Nail Clipper factory. Statements in favor of and opposed to the proposal have been submitted by the local Chamber of Commerce and by the State Audubon Society. They are reprinted below.

STATEMENT 1 FROM HELEN B. WORTHY, EXECUTIVE SECRETARY, JAMESVILLE CHAMBER OF COMMERCE

We strongly support the proposal for a new industrial park in one corner of Smith's Marsh. Our reasons are these:

a. The marsh has not been used by humans in over a hundred years. It contributes nothing to the economy or well-being of our community.

b. The proposed new plant would be a valuable addition to the community. It will hire 50 new workers, good news in a city where unemployment rate is near 9%.

c. The marsh is a breeding ground for mosquitoes. Developing one section of the marsh should reduce this problem.

d. If the new region is successful, we may be able to open other sections of the marsh to industrial development.

STATEMENT 2 FROM HELEN R. REDWING, PRESIDENT, STATE AUDUBON SOCIETY

We strongly oppose the proposal for a new industrial park in one corner of Smith's Marsh. Our reasons are these:

a. The marsh is a breeding and feeding area for more than 30 different kinds of birds and mammals. Destroying this useful part of the marsh would eliminate more than 10% of the feeding and nesting grounds on the marsh.

b. Hundreds of people enjoy the beauty of the marsh: fishing, canoeing, hiking, and birdwatching are all popular pasttimes.

c. The State Engineer's Office reports that the marsh may help control flooding on Duck Creek. Paving the lower end of the marsh may increase flood problems in this part of the city.

d. More than 3000 acres of wetlands are already being destroyed each year in the state. We can not afford to continue this practice.